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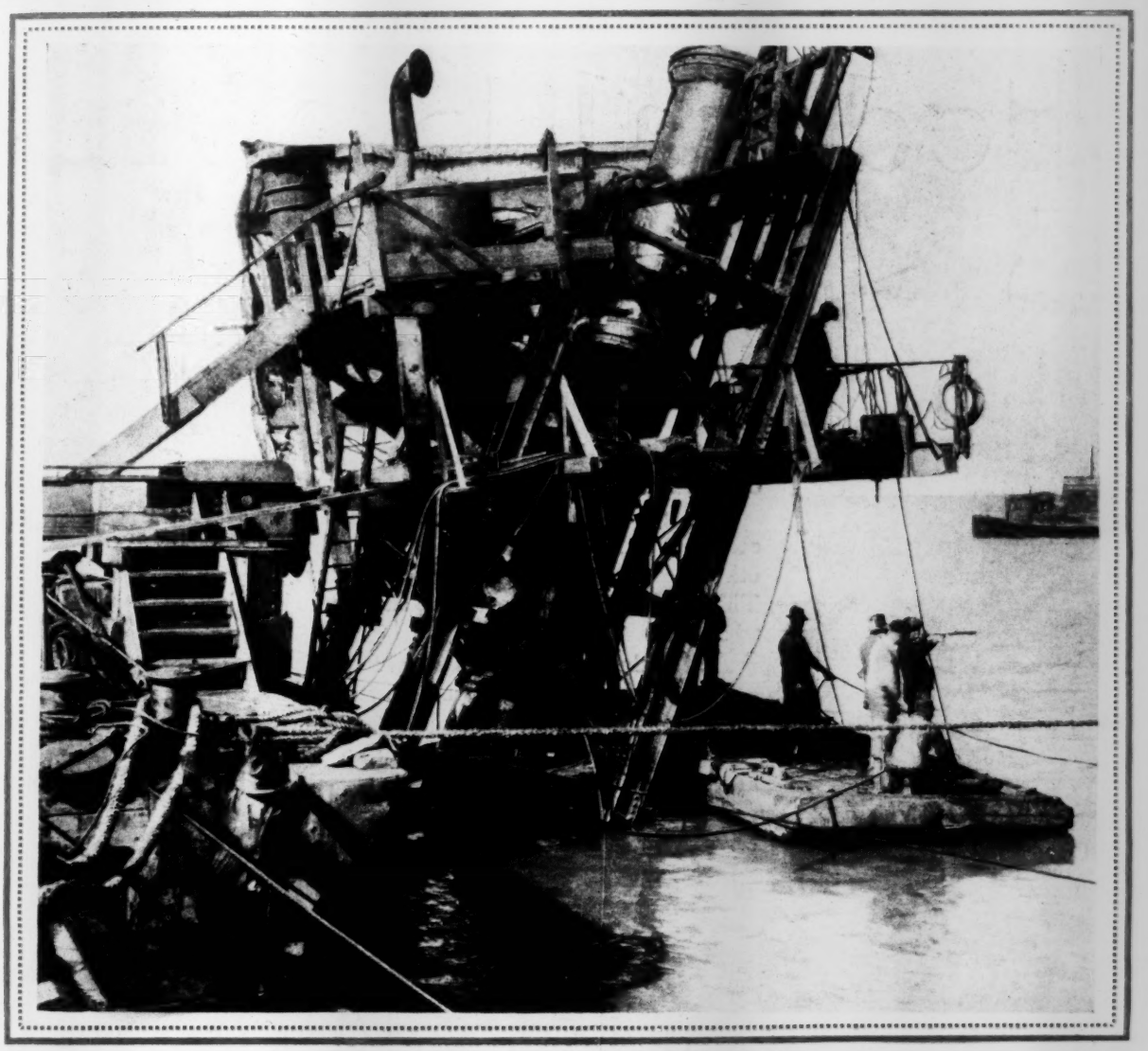
Engineering News-Record



Heavy Steel Cradle for Laying 42-In. Water Supply Line Under San Francisco Bay

Traveler of 500-Ton Weight Erects Heavy Trusses for Theater Roof

San Francisco Bay Crossing of Hetch Hetchy Aqueduct

Staff Report of A. R. E. A. Annual Convention

New York State Official Censures Surety Bonding Practice

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 96 NEW YORK, MARCH 18, 1926 Number 11

Backbone Justified

THERE are times when the engineer in public service becomes discouraged at his lot. The people, whom he serves, seem to take him as a matter of course or notice him only to criticize what he does. Politicians come and go, reap rewards both honest and dishonest, and take credit for the work he does. He goes on, inadequately remunerated, buoyed up only by a sense of public service. And then there comes along some such incident as that now developing at St. Louis and he realizes that after all the people do appreciate what the engineer is doing for them and that politicians can only go just so far in glorification of their own importance, provided the engineer has sufficient backbone to stand for the right. It is too early in the attempted dismissal of E. E. Wall from the directorship of public service by the mayor of St. Louis to say just what will be the immediate outcome. But the instant protest of the citizens of St. Louis to such high-handed treatment of its technical officials should encourage all city engineering officials to emulate Mr. Wall in his assertion of the technical man's right to the governing of technical matter under his control.

A Feudal Revival

IT IS quite conceivable that the friends of the governor of Illinois may want to lend pecuniary aid to him in his present campaign for justification. But it is another thing to assume that employment in a state engineering department carries with it such automatic friendship. The engineers of the state highway department of Illinois have a right to resent the implication of their superiors that such a relation between them and the governor exists. To admit it would be to revive feudal days. The overlord is in distress. Let the vassals pay in proportion to their estate. The heads of the highway department see only a suggestion for voluntary contribution in their action. To the average low paid engineer, none too certain of new employment, settled in his home and satisfied with his work, the suggestion can be little short of a demand. And as such it shows a political influence unfortunate in a department which has made such a conspicuous success of its engineering achievement.

Shun Mixer Overload

RATED capacities of paving mixers are astonishingly close to true capacities, according to tests conducted by the California highway department. A more significant indication of the tests, however, is that any material overload introduces hazards to the quality of the concrete. Probably the thought of paving contractors concerning mixer overload has been that while it might shorten the life and lengthen the repair bill of the machine there was no harm to the product or at least none that half a minute added to the mixing time would not repair. It appears from the California tests that neither assumption with respect to product is accurate. With any material overload the concrete tested lower than when the rated batch volume was employed. Mixing the overload batch half a minute longer did not prevent the loss in strength. Two makes of mixer, both standard, were tested and gave corresponding results. Each exhibited a test capacity corresponding to its rated capacity, showing that, in the words of the testing engineers' report "the mixer had been honestly and accurately rated by its designing engineers." Truly association work by the mixer manufacturers has put the concrete paving mixer on a high plane as construction equipment. It should be appreciated by constructors. And they too can well bear in mind that mixer overloading is poor practice regarded from any viewpoint.

Unwise Restrictions

MAYORS of a number of Arkansas municipalities have recently banded together to seek the nullification of a legislative restriction, several generations old, against the issuance by municipalities of bonds for public improvements. What legal steps are necessary to such an end were outlined in *Engineering News-Record*, March 11, p. 423. And what onerous responsibilities the present improvement-district plan of public works construction imposes upon city engineers are hinted in an article in this issue, p. 442. After reading this story on the professional vicissitudes of Little Rock's city engineer, it is obvious that that job in any Arkansas city calls first for the fortitude of a Job, and then the resource of an Aladdin. It is to be hoped that the Arkansas mayors' campaign will gain its objective.

Economics in Railroading

THAT the American Railway Engineering Association is alive to the need for better and more economical operation of the railways of the country is evident from a review of the meeting of the association at Chicago last week. Economics of railroad location, an old subject, was supplemented some years ago by the consideration of the economics of operation and of labor. These are major committee assignments but economic questions arise in other committee reports, such, for instance, as the economics of trestle filling and the economies in the use of ties and in the uses of wood. Moreover, there is a growing tendency to modify specifications for material to make them suit commercial requirements without sacrifice of fundamental requirements. At this year's meeting new interest was aroused in the old subject of the economics of railroad location by a report on the relative merits of 0.3 per cent grades over the generally accepted ruling gradient of 0.4 per cent for high class railway lines. Discussion of the report stressed the growing importance of grade re-

vision as a major economy in railroad operation and it was suggested that the committee go into the operating side of grade reduction more fully. In addition, objection was made to the inclusion in the manual of purely theoretical conclusions concerning such subjects as the effect of block signals on single track operations, conclusions which do not work out in practice. These are healthy signs. The A. R. E. A. does well to devote more time to such subjects at the expense of subjects in which it overlaps the work of other organizations.

Making the Road Smooth

CHECKING up with a chalk line is a precaution which the resident engineer on road work could well adopt more often than he does. Proud of his instrumental work he feels that after putting in the grade stakes all that is needful has been done. For the sake of professional vanity let us say that it is, and then when we set the forms for a widened, superelevated curve or are laying out an intersection or are dishing for a catch basin or have to introduce a warped surface anywhere, let us get out the old chalk line and stretch it this way and that and squint along it and under it and observe how the calculated surfaces look. It is marvelous how clearly a water pocket or a hump will show up under a chalk line. Level readings do not make it nearly so plain. Only riding over the road—after it is too late to make changes—betrays the mistake as sharply as does the chalk line. Let the young engineer be not ashamed of the chalk line. So trained a road builder as the construction engineer of the New Jersey State Highway Department did not scorn in a recent paper to devote several paragraphs to explaining the value of this homely device. Journeying recently with the engineer over the closest succession of vertical and horizontal curves ever traveled on a paved road the engineer remarked that he never would have secured so easy a riding road had he not gone over every curve with a chalk line; and he was an old railroad location engineer. Checking up with a chalk line is a satisfaction even though it only verifies the accuracy of the instrumental work. And sometimes it discloses a needed correction.

A Great Enterprise

TWO important steps toward bridging the Hudson at New York City were taken last week. New Jersey made an initial appropriation toward the construction of a bridge (contingent on a similar appropriation by New York State), to put the Port of New York Authority in the position for proceeding with the project on the basis of bond issue financing; and the engineering staff of the Port Authority made public its studies and plans for the bridge, as developed during the past year. The project is reported to be economically feasible, being "self-sustaining in every respect from the first year without imposing unreasonable toll charges," in spite of its huge proportions. A suspension span of 3,500 ft. is required to make the crossing. The location chosen, at Fort Washington Point, or approximately on the line of 178th St., will provide a through highway route from a great area in northern New Jersey and adjacent communities in the southern part of New York State not only to the city of New York but also to the roads leading eastward along the Sound shore toward New Haven and beyond. An investment of something like $50,000,000 is required. On the engineering side, the project is unprecedented, involving a span just twice that of the world's greatest suspension bridge—that at Philadelphia—and within a small margin of twice the world's greatest bridge span of any type, that of Quebec. Yet it is well established that from its technical standpoint the project is entirely possible and "will involve no extraordinary difficulties." The definite conclusion that it is also economically possible, and the willingness of the communities concerned to make the initial contribution to its cost, seems to offer a fairly certain assurance of its early realization.

State Water Supply Zoning or Ownership?

IT IS doubtful whether any plan to provide an additional water supply for a large urban population ever aroused as much and as strong opposition from so many quarters as the one now before the Massachusetts Legislature to meet the needs of Boston and vicinity. In commenting on this opposition before the New England Water Works Association last week, Allen Hazen, engineer of the commission that submitted the plan, suggested state zoning of public water supplies as a way to meet changed conditions as to water takings that have arisen in the last thirty years. His comments on the subject, which are given elsewhere in this issue, deserve country-wide attention because the taking of water for municipal purposes presents increasingly difficult problems in every state of the Union. What can the states do to conserve their public waters for the benefit of all and against the undue advantage of any? The New Jersey Water Policy Commission, in its recent report, suggests state acquisition and holding of water supply sources, with local development—by regional commissions for most of the state—the state to be reimbursed as the water is taken for use. Either state acquisition of land and water in fee simple or of water rights alone could be effected by negotiation or condemnation, while zoning, as now understood, is the exercise of the police power, without compensation. But the states have powers over the use of water that they lack as regards the use of land and these might be utilized in working out some such state water supply zoning plan as Mr. Hazen proposed last week.

Contract Bonding in the Limelight

STATE Architect Sullivan's report on the contract surety bond situation in New York confirms the views regarding this phase of contracting reported by the joint conference of contractors and engineers. The surety business is in an unsatisfactory state, due partly to the sureties themselves but more to the general conditions of contract letting for public works. The basic difficulty lies in the requirement that a public contract must be let to the lowest responsible bidder. This requirement is practically forced by the sinister possibilities of freedom of choice of bidder by a political body, which in its turn has brought about the almost universal practice of accepting the bond of a surety company as guarantee of responsibility. The state, therefore, shifts its judgment to a private corporation, engaged in competitive business and driven by that competition into the taking of chances which for the individual case permit greater leeway of judgment because of the distribution of losses over a large number of risks. Naturally there grows up in the getting of this

competitive business a number of practices which can stand correction. All this Mr. Sullivan sets forth as the result of his examination. It is not a new picture that he presents, but that he should present it after thorough study and thought shows that earlier criticisms of the same nature were warranted.

But when it comes to remedies the state architect is almost as much at a loss as have been most of the earlier reformers. His proposal is that the state should in effect assume its own contract insurance, which requires that the state officer must be able to determine contractor responsibility, and be free to choose other than the lower bidder. Mr. Sullivan's criterion of responsibility, as set forth by his proposed law, does not appear to be workable. There are other necessities than that the bidder should show "assets in excess of liabilities to the equivalent of 15 per cent of the contract." This the report recognizes, for it adds that the contractor must have successfully executed work of the character contemplated and "shall further prove his responsibility to the satisfaction of the state architect." Here is the rub. In an ideal state this is admirable. But unfortunately political officers are frequently criticized and, less often, criticizable, for favoritism. To put into the officer's hands such freedom of throwing out the low bidder is hardly possible in this imperfect world. The suggested stiffening of payment methods, too, while it may serve to discourage reckless bidding may conceivably also serve to boost the responsible bids or to keep such bids away altogether.

Mr. Sullivan has furnished the surety companies and public officials both much food for thought. He has not solved the difficulty, but he may well have started a movement which will lead to its solution.

A Recurrent Ghost

ONCE more the ghost of the Lakes to the Hudson ship canal arises. Every so often it drags itself forth to plague the public for a season until the political crisis which invokes it has passed—and then it retires again to limbo. Its last appearance was in the early days of the century when certain interests embarked on what turned out to be a successful campaign to hoodwink the people of New York into spending $101,000,000 on a barge canal. It was fairly obvious that such a canal was an economic fallacy but the waterway boomers were strong in the land, so the only line of attack that seemed at all plausible was to go them one better and to urge that if anything in waterways was to be built the state should not go half way but should either by itself or with the federal government build a real waterway from lakes to ocean through which real ships could steam. It should be that or nothing, and the seaway was so expensive and its results so doubtful that it was hoped that the voters would decide on nothing.

But the barge canal prevailed. It was built, not at a cost of $101,000,000 but of upwards of $250,000,000, and now, twenty-five years after, it is a white elephant on the hands of the state. The governor would give it away to the nation, provided that the nation then sets to and builds the ship canal. The hidden hand of politics again slips from behind the curtain. It is not often that a presidential aspirant can at the same time twist the Lion's tail, offer reduced grain freight rates to the Western farmer at federal expense, set Buffalo and Albany to dreaming dreams of world greatness and finally to placate the timid souls in New York who see that metropolis dwindling away to the stature of Pohick on the Creek. As a serious economic or engineering suggestion the ship canal proposal is an admirable political gesture.

Government engineers are now preparing a final report on the ship canal. Soon their report will be available. Around it will swirl for a time a fog of argument. It is not necessary or desirable now to devote much attention to this argument, but it is worth while to set down a few pertinent facts.

The engineers estimate that the canal from Oswego to Albany would cost $500,000,000 and the cut around Buffalo between Ontario and Erie $125,000,000 more. The major argument in favor of the proposition is that it is all-American, which obviously demands that the western section be built because in the event of the supposititious war that so worries Secretaries Davis and Wilbur a ship canal tapping Ontario would be useless and the Welland Canal, which in times of peace is supposed to make the tie-up to the upper lakes, is just as much Canadian property as the lower St. Lawrence bug-a-boo that the Hudson canal advocates wave before us. So at the go-off we have an estimate of six hundred odd millions, which as every one knows means a billion or more before Cleveland or Duluth become seaports.

And what do we get for the billion? It is 327 miles by the route from Buffalo to Albany; 150 miles are in open lake or river, 75 miles are in narrow canalized rivers, 102 miles are in constricted canal. There are numerous locks, the number depending upon the lift but the barge canal traversing the same district has 41. And worst of all the canal cuts through some of the busiest territory in America. Roads and railroads without number cross the route and at every crossing there must be a lift bridge. Look at the road and rail map around Buffalo and see what the canal means there in delayed land transportation. And finally the canal carries with it practically no supplementary waterpower, except that gained by the Niagara fall, which could be generated much more cheaply by other means.

The project is feasible from an engineering standpoint, the army engineers report. That is fairly obvious. So is a 50-ft. ditch straight from New York to San Francisco. Given time and money the engineer can build a canal anywhere. He can supply Los Angeles with Penobscot water or empty Okeechobee into the Potomac. But will it pay? Will anyone use it once it is built? It is fast becoming axiomatic that long distance ship canals have possibilities of economic justification only when the far greater part of the waterway is in natural channel, of easy traversing and low maintenance. To attempt to predict travel, against rail competition, on an artificial waterway over 150 miles of which is in narrow canal and through locks is to break a new road in prophecy. Nothing like it exists; there are no data to go on. The odds are against it.

Reverberations at Washington show that Governor Smith's proposal is taken as a direct challenge to the St. Lawrence ship canal. Assuming that the canals are mutually exclusive there can be no comparison of the two on engineering grounds. If the St. Lawrence passed entirely through United States territory the Hudson canal would be laughed out of any engineering court. But the St. Lawrence presents international complications and national policy will govern in its consideration. Only on this ground can the New York canal be discussed as a competitor of the international route.

San Francisco Bay Crossing of Hetch Hetchy Aqueduct

Methods Used in Laying Flexible 42-In. Pipe on Channel Bottom and in Building Bridge Over Shallows and Large Pier Between Channel and Bridge Sections

THE Bay Crossing Division of the San Francisco Hetch Hetchy water supply project is being built now, seven years before it can be used to convey Hetch Hetchy water, in order to supplement pipe lines now loaded to capacity that bring in water from East Bay sources of the Spring Valley Water Co. As a whole, the Bay Division now being completed includes about 21 miles of line from a point near Irvington on the east side of the Bay, to Crystal Springs reservoir of the Spring Valley Water Co. This reservoir is on the San Francisco peninsula about 15 miles south of the city limits.

Except for Pulgas tunnel (8,675 ft. long) and the submarine pipe in the Bay (a length of 2,750 ft.) and across Newark slough (400 ft.) all this mileage consists of a single 60-in. pipe with a capacity of 45 m.g.d., buried in trench or laid on trestle. The plan is to supplement the 60-in. line later by additional lines as they are needed; the capacity of the tunnels in the mountain division already built is 400 m.g.d. Water from the Hetch Hetchy source will flow into Crystal Springs reservoir by gravity. During the use of the line for bringing in water from the Spring Valley's Calaveras watershed, a temporary booster pump station has been installed on the west side of the Bay crossing to put the line under the pressure necessary for delivery. A general résumé of the status of the Hetch Hetchy project appeared in *Engineering News-Record*, June 18, 1925, p. 1021, and the agreement between the Spring Valley Water Co. and the city on the Bay crossing division was outlined May 4, 1922, p. 751. The following description deals with the Bay crossing proper, including 3,870 ft. of steel bridge on the west side of the Bay, terminating at the outer end in a thrust pier and a flexible 42-in. pipe laid on the Bay bottom between the thrust pier and the east shore.

In deciding on the type of the Bay crossing, the bridge and large pier were selected in preference to a submerged pipe all the way across for reasons of ultimate economy. The bridge, which is designed for two 76-in. lines in the ultimate development, is now carrying one 60-in. line. The overall cost of the thrust pier and bridge complete with the present 60-in. pipe is about $400 per foot of bridge. This is approximately equal to the cost of two lines of 42-in. flexible submarine line including the cost of pipe, trenching, laying and backfilling; a total of about $200 per foot of single line. A like amount at least would be required for each additional line of submarine pipe, whereas the additional cost of the second steel pipe on the bridge will be only about $30 per foot.

Expansion joints in the pipe and anchorages on bridge piers are such that no thrust due to temperature is to be carried from the pipe itself into the thrust pier at the end of the bridge except the force necessary to move the last expansion joint. This pier, however, is designed to withstand the unbalanced overturning moment of the hydrostatic thrust from the two 76-in. pipe lines under full pressure of 170 lb. per sq.in. as well as the thrust from the submerged lines or any combination of thrust with either or both pipe sections empty or full.

The pier is designed for four 42-in. pipe risers interconnected at the top and at the bottom leading out into the Bay through the walls of the pier, only one of the four being built now.

Perhaps the most interesting feature of the work

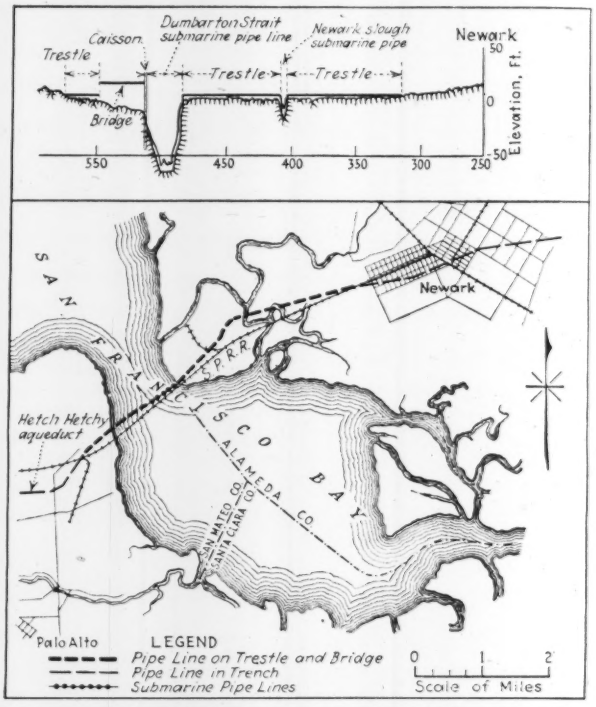


FIG. 1—MAP AND PROFILE OF AQUEDUCT BAY CROSSING

was the design and construction of the thrust pier, Fig. 2, which is of large proportions for a concrete structure nearly a mile offshore. The total height of the concrete work from base to top is about 98 ft. and the quantity involved is about 4,900 cu.yd. exclusive of the yardage in temporary concrete structures. About 900 cu.yd. was placed with tremies and the remainder was poured in the dry.

The plan of construction adopted to avoid danger of spreading the surrounding caisson cylinders was first to drive the wooden piles in the area on which the concrete was to be placed, and then to begin the construction of the caisson in which the pier was to be built. The caisson was constructed by first putting down 21 steel cylinders 80 ft. long and 9½ ft. in diameter, which were in themselves small caissons within which excavation could be made and the concrete placed. The steel cylinders were equally spaced on the circumference of a circle 72 ft. in diameter. When the concrete within these steel cylinders was in place, constituting a ring of small piers, the steel cylinders were pulled and a double line of steel sheetpiling giving a wall 3 ft. thick was driven to connect the adjoining concrete piers and

the space afterwards filled with concrete, thus enclosing the area on which the main pier was to be built.

A total of 715 wooden piles was used in the foundation including 64 batter piles driven on a 1 to 2 slope to carry part of the hydrostatic thrust, and the nine driven in each steel cylinders. Under the center of the pier the pile centers were 2½ ft. apart in one direction and 3 ft. in the other. The chief concern with the piles was to get them down into the firm yellow clay, not only to increase their bearing power but also to strengthen them against the lateral thrust which is an important factor in the design of this pier. These piles extended an average depth of about 40 ft. below the concrete level and were driven with a No. 2 steam hammer having a 5,000-lb. ram.

The steel cylinders were made of steel sheets from ¾ to 1 in. thick, and were driven through some 70 ft. of mud, sand and gravel, by means of a 9,600-lb. drop hammer. On the bottom of each cylinder was a 5½-ft. extension or shoe of steel, ¾ in. thick, which was

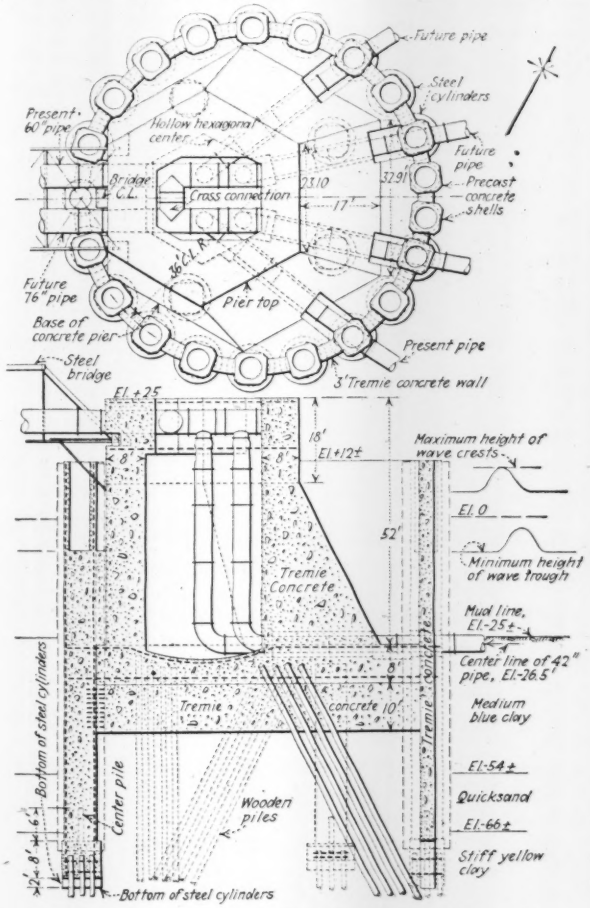


FIG. 2—PLAN AND ELEVATION OF THRUST PIER

unbolted and left in place when the cylinder was pulled, thus assuring the firm and undisturbed contact with the stiff clay at the bottom that resulted from driving the cylinders.

Generally speaking, these cylinders went down well although there was some difficulty due to striking old piles. Excavation inside the cylinders was carried on in some instances as the cylinders went down and occasionally water jets were used in the mud above the firm clay. When each cylinder was driven to final position, with its bottom about 75 ft. below tide level, it was pumped out, the bottom leveled off to specified grade and the nine piles were driven, spaced to exact position with a templet.

In one of the first cylinders put down a test was made to determine the resistance of these piles to lateral thrust. The test was made by jacking from the head of one pile to a horizontal beam placed between two

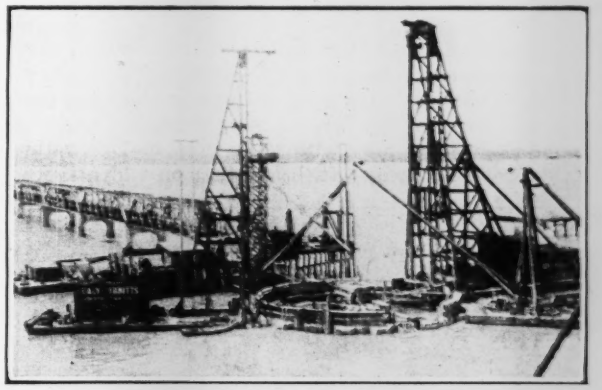


FIG. 3—GENERAL VIEW OF BRIDGE AND CAISSON FOR THRUST PIER

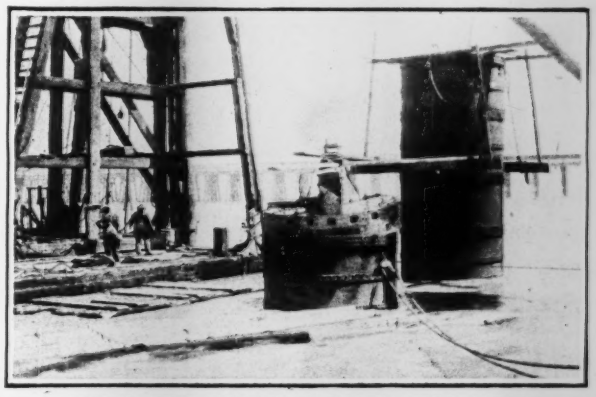


FIG. 4—TWO OF THE 21 STEEL CYLINDERS

others and observing the deflection of the beam. The beam had been previously deflected in a testing machine and the deflection for given loads recorded. In this test the piles satisfactorily resisted practically twice the maximum load they will have to resist under operating conditions. The test was considered notable in that it was conducted nearly 80 ft. below tide level without the use of compressed air.

The concrete forming the piers inside the steel cylinders was poured in forms of precast hollow concrete shells, 5 in. thick, 78x78 in. in plan. These shells were made in two sections to make up a total length of 70 ft. After placing the shells heavy steel reinforcing was put in to resist the bending moments and the cores were then filled with concrete up to low tide level, where they will be cut off after they have served their construction purpose. On opposite faces of each of these piers a portion of a vertical sheetpile was left projecting, and these were later used in completing the caisson wall.

Pulling the steel cylinders called for heavy tackle, and a barge was used which had a rated lifting capacity of 100 tons. Although the steel cylinders weighed only

about 36 tons, the barge was able to loosen them only by exerting a pull sufficient to partially submerge the barge and then, by releasing a predetermined length of cable, to allow the barge to rise suddenly under the buoyant force and bring up with a jerk against the tackle fastened to the cylinder top. Some came away readily and on others repeated jerking over a period of as much as four hours was required.

With the steel cylinders removed, the double wall of steel sheetpiling between the precast piers was driven in place, the 3-ft. space between these walls was excavated with a small orangepeel bucket and then filled with tremie concrete.

With the walls of the open caisson in place the next step was to excavate with mud pumps the material around the wooden piles within the caisson. Excavating in this way to a level 1 ft. below that on which it was

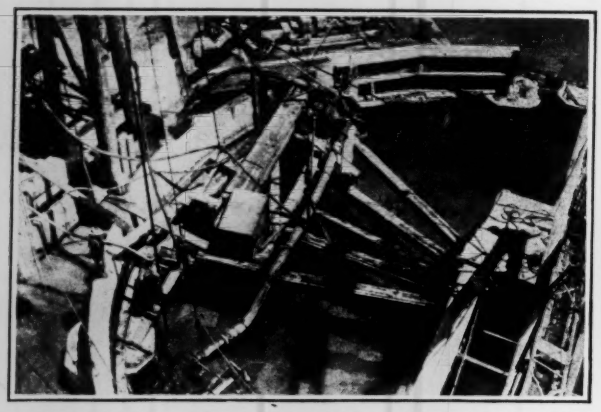


FIG. 5—LOOKING DOWN ON CAISSON MUD PUMP AT WORK

Note sheet piling used to form walls between the small piers of the caisson. Two mud pumps were employed in unwatering for pier construction.

desired to begin pouring tremie concrete necessitated the removal of 2,600 cu.yd. As this pumping was carried on water was admitted to the caisson to avoid unbalancing the pressure on its bottom. A 1-ft. layer of crushed rock was then placed and on this a concrete bottom or seal 10 ft. thick was poured inside the caisson by means of tremies. This was done in a continuous 3-day pour, using two mixer outfits which began with both tremies delivering to a point near the wall of the caisson and with the two outfits working away from each other over separate halves of the bottom thus securing a continuous pour for the entire plug.

Four bleeder pipes were placed in this seal at the time of pouring so that when the caisson was pumped down 15 days after pouring it was possible to note whether the unbalanced pressure was causing a flow of water into the space beneath the seal and inside the caisson ring. If such leakage had occurred it was planned to pump away this infiltering water until a sufficient yardage of concrete had been placed in the pier to balance the uplift. However, there was only a very small amount of seepage through these bleeder pipes and pumping from beneath the concrete seal was unnecessary.

It is notable that after unwatering this caisson which had an outer circumference of about 250 ft. and the bottom of which was 45 ft. below tide level there was no seepage, the inside faces of the walls being dry.

With the tremie seal in place the placing of forms and building up of the concrete pier in the dry was a comparatively simple operation, except for the bending and placing of the foundation reinforcing steel which was somewhat complicated. Fig. 6, the shore side of the pier, is vertical and the opposite face, which lies in the direction of the hydrostatic thrust from the pipes on the bridge, is battered on a slope of one horizontal to two vertical as an aid in resisting the overturning moment. Some three or four feet of the bridge span resting on this pier was embedded in the concrete and thus anchored firmly in place. The concrete was poured directly against the end floorbeam but around the end posts and on the bottom chords were wrapped three layers of $\frac{3}{8}$-in. felt saturated with hot airblown asphalt, thus providing a small space in which the members will have freedom to deflect under the action of

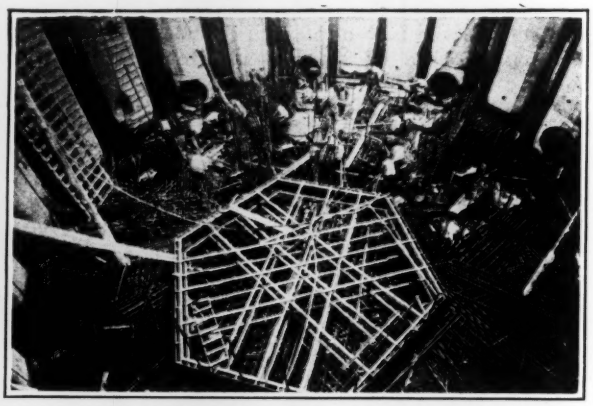


FIG. 6—PIER REINFORCING BEING PLACED IN CAISSON

Note dryness of walls. Reinforcing bars extend into all shells except the four carrying pipe sleeves. Forms in center for hexagonal core of main pier.

the vertical gravity loads, and more especially under the reversing horizontal loads due to temperature and hydrostatic thrust loads on the end thrust pier.

The plans originally worked out for this thrust pier have been several times changed. It was originally proposed to lay in the submarine section six lines of 36-in. pipe, but when the New York Board of Water Supply successfully placed the 42-in. flexible pipe, the Hetch Hetchy plans were changed to provide for four 42-in. lines. Again, as late as when the first steel cylinders were put down and a layer of quicksand which preliminary exploration had not disclosed was found above the firm yellow clay, it was decided to increase materially the depth to which the surrounding caisson would be carried and make this a part of the permanent structure. This decreased to some extent the depth to which it was considered necessary to carry the concrete level in the pier proper. In general, the San Francisco Bay submarine crossing was built with much the same equipment and method as was employed on the New York work.

Unevenness of the Bay bottom and the desirability of laying the pipe on as uniform a grade as possible made it necessary to excavate the trenches to depths as great as 24 ft. in some places. With a 3 to 1 side slope this called for considerable separation of the four submarine lines. Accordingly, in order to get the desired spacing in the channel the design is for easy curves in the outer lines of pipe where they leave the thrust pier.

For the first 234 ft. from the pier base, this portion of the line being on curve, the pipe was laid from a temporary trestle, thus making it possible to pour the lead joints above water and lower the pipe uniformly after a considerable length had been completed. Connection to a sleeve through the wall of the thrust pier was made with an under-water calked lead wool joint. From the outer end of this trestle on the west side of

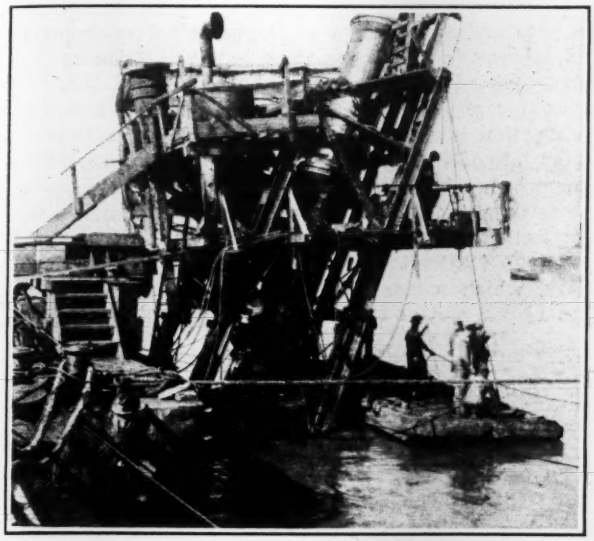


FIG. 7—UPPER END OF STEEL CRADLE AND FORWARD END OF BARGE

the crossing the work of making joints was transferred to the barge and cradle and thus proceeded across the channel to a similar temporary trestle on the east shore. Here the submarine and shore sections were joined on the bottom by a diver and calked with lead wool.

The trench for the pipe was excavated with a clamshell bucket, and was gone over a second time to clean it out; then a layer of rock 2 to 4 ft. thick was then placed also with a clamshell. Finally a steel drag was used to level off the rock. Most of the trench was on easy grades but at the east end there was a short maximum grade of 17 per cent.

The arrangement of the barge and pipe laying cradle was such that the minimum depth of water in which the rig could work was about 30 ft. The barge was held

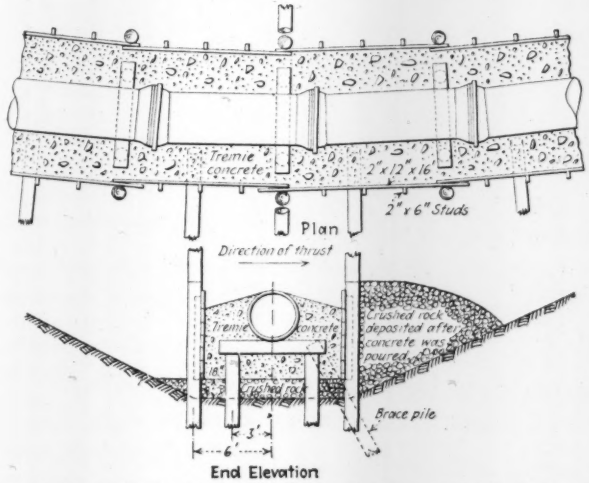


FIG. 8—METHOD OF ANCHORING PIPE ON CURVE

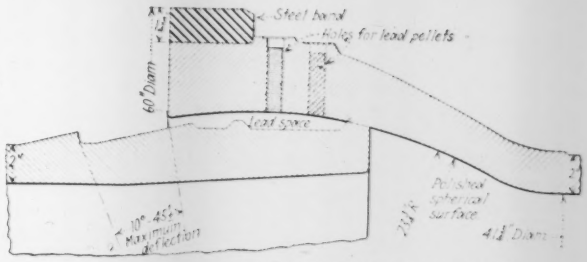


FIG. 9—DETAIL OF FLEXIBLE LEAD JOINT

in place by means of 12 anchor cables, four on either side and two on each end, which were pulled taut by steam winches. The tidal current in the channel at this point, which is about 30 miles down the Bay south of the Golden Gate, ranged up to about 5 miles per hour and a maximum tide range of almost 12 ft. was recorded although during the laying the tide did not exceed about 8 ft.

The pipe sections are 12 ft. long with a barrel thickness of 2 in., and weigh 6½ tons per length. The maximum deflection in joints that can occur before the pipe shoulders are brought up, metal against metal, is 10¾ degrees.

The bell ends of the pipe sections were ground and polished at the factory to a spherical surface and the entering spigot end was provided with a ring that served as a dam for retaining the 400 lb. of molten lead poured into each joint, Fig. 9. Shrinkage in the cooling lead was taken up and the joints made tight again by the insertion of ⅝x1¾-in. lead pellets which were put in cold under pressure through 40 tapped holes distributed around the circumference of the bell end.

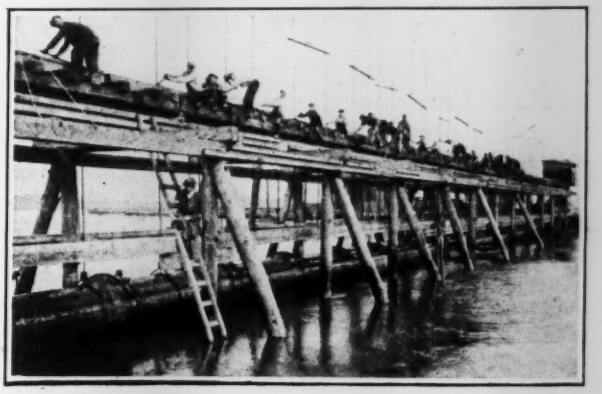


FIG. 10—LOWERING PIPE FROM TRESTLE ON EAST SHORE

The holes were finally closed by threaded plugs. Forty-five minutes was the maximum time on calking a joint and the best time between moves was 1 hr. 15 min. The best progress was 13 joints in 24 hours but the maximum progress in pipe laying was often delayed while the trench was being prepared ahead of the pipe laying rig.

As each joint was calked it was deflected slightly to shear off the lead pellets projecting from the 40 holes. Every tenth joint was given a water-pressure test of 170 lb. per sq.in. before it left the cradle. This was done by means of a double-ended test head on each end of which were rubber gaskets that could be inflated with water pressure after the test rig had been inserted in the pipe. An air pressure test of 50 lb. per sq.in. is planned for the entire line and after all backfilling is

placed a hydrostatic test of 170 lb. per sq.in. at zero level is to be kept on the line for 24 hours, and the leakage measured.

The backfill in the trenches will consist of crushed rock enough to cover the pipe. The method of placing the curved section on the west end is shown in the accompanying sketch, the concrete having been placed to resist any tendency to straighten out the curve under pressure.

On the barge the pipe-laying crew consisted of a superintendent, foreman, two engineers, ten pipe men and two laborers. There were two crews, each working 12 hours and the 228 lengths in the submarine section were placed in 30 days.

Where the pipe was lowered from the trestle this was accomplished by means of 1¼-in. threaded rods extending from the trestle down to bands around the pipe sections, two bands being used on each 12-ft. length. Tar paper was used to prevent the bands from damaging the protective coating on the pipe. At the top the threaded rod passed through a cap timber carrying a washer and nut. On the latter a wrench with 4-ft. handle was provided for hand operation and when the pipes were to be lowered a crew of 40 men manned these wrenches and uniformly lowered the pipe so as to avoid deflection of joints.

The Bay crossing division was constructed under the general direction of M. M. O'Shaughnessy, city engineer, N. A. Eckart, principal assistant. R. P. McIntosh was designing engineer on structures and Leslie Stocker on submarine pipe. C. R. Rankin was resident engineer on the Bay crossing division. The pipe was manufactured by the United States Cast Iron Pipe Co., and contract for placing the pipe and also for building the bridge piers and the large caisson was carried out by Healy-Tibbitts Construction Co. The bridge spans were fabricated, delivered and placed by the United States Steel Products Co.

How Land Development Is Financed In Various Countries

LONG-TIME land loans are provided in government land settlement work in many foreign countries, according to data given by Prof. W. W. Long, of Clemson Agricultural College, Clemson, S. C., at the conference on reclamation and land settlement held at Washington, Dec. 14. The time allowed for principal repayment in these various countries ranges from 33 to 75 years. Interest is charged in all cases.

In comparison, it is to be noted that the United States land settlement policy as laid down in the federal reclamation law originally called for repayment of principal without interest in 10 years, but was amended before payments had been made to provide for no-interest repayment of principal in 20 years. The latter arrangement is equivalent to 1½ per cent interest per year and amortization of the principal in 20 years, and represents about the same annual burden as the longest-period foreign system, but continued for only a fraction of the length of time. Under the amended reclamation law of 1924, which authorizes repayment at the rate of 5 per cent of the gross crop return, direct comparison with the foreign systems is not possible. It has been estimated that on a number of projects the new repayment method would result in paying off the principal (without interest) in periods of 50 to 100 years, which means that annual payments would be ¾ to 1½ per cent of the principal, without interest.

REPAYMENT TERMS OF GOVERNMENT LAND SETTLEMENT ABROAD

Countries	Rate of Interest, Per Cent	Time Given to Pay for Land or for Repaying Loan
Denmark	3 to 4	65 years
Italy	2 5	50 years
Holland	4 7	.....
Norway	3 5 to buy land and 4 to owners	.....
Hungary	4	50 years
Austria	4 to 4 5	54½ years
Russia	4 5 principal and interest	55½ years
Germany	3 5 to 4	56½ years
France	4 to 4 5	75 years
England	4	50 years
Ireland	3 5	68 years
Belgium	4 5	30 years
Switzerland	4 5	57 years
New Zealand	4	36½ years
Victoria, Australia	4 5	36½ years
New South Wales	3 to 5	30 to 40 years
Other Australian States	4 to 5	30 to 40 years
British and German South Africa	4	.....
Chile	4	33 years
Argentina	4	.....
British Columbia	1 per cent more than the interest on state bonds; 5 per cent at present	36½ years

Large Cantilever Planned for Mount Hope Toll Bridge

Span of 1,200 Ft. Recommended for Rhode Island Bridge—Trusses to Have Three Chords—Tolls Will Repay Cost Rapidly

REPORTING on the results of an eight months' study of a possible toll bridge to connect the island of Rhode Island with the mainland at Bristol, crossing the entrance to Mount Hope Bay, a state commission has just reported to the legislature that the traffic amply warrants the construction of such a bridge and that a cantilever structure with main span of 1,200 ft. should be built. The design proposed for this cantilever is of novel character, both in its general proportions and outline and in the detail construction advocated by the commission. It is proposed that for economy in floor construction the cantilever structure shall consist of four lines of top chord, but that there should preferably be only two bottom chords, each connected with its pair of top chords by two inclined web systems. The cross-section of the bridge would thus show two structures of triangular cross-section.

The following main features of the recommendations are abstracted from the report:

Location—The natural location of the bridge is from a projecting point of the mainland a short distance south of Bristol to the northerly point of the island, north of Portsmouth. The strait here is about 3,000 ft. wide, shore to shore. Both shores are rocky, and the subaqueous topography as well as borings showed that the whole width of the channel is in rock with only a few feet of earth cover. At the north or mainland end the rock is granite, while the southerly half of the crossing and the outcrops on the island are slate. The shores rise rapidly to a height of more than 100 ft. above water level. The channel depth is something more than 80 ft. on a width of some 300 ft., but the bottom rises rapidly enough so that piers 1,200 ft. apart would reach rock at about 20 and 30 ft. depth respectively.

There is much shipping through the strait, but the necessary provision for masted vessels is readily made in view of the shore configuration. The scheme provides clearance heights under the suspended span ranging from 137 ft. to 152 ft.

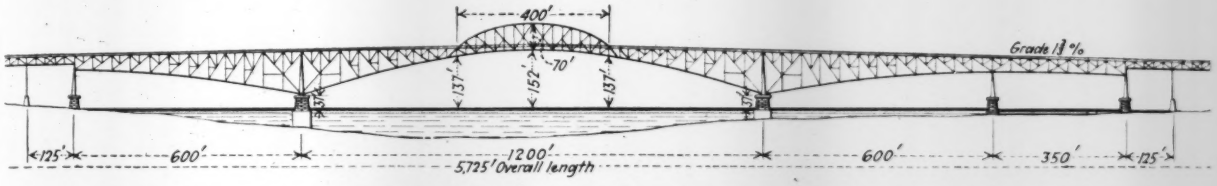
Type of Structure—Three types of structure, suspension, cantilever and arch, were compared. The most economically proportioned suspension bridge, says the report, would involve an unnecessarily long central span and the construction of massive anchorages, only one of which would be on the shore, resulting in a total cost greater than for the cantilever type. A series of braced spandrel steel arches was considered, but the many foundations would increase the cost extensively. It was concluded that a cantilever bridge with 1,200-ft. main span would be the best adapted to the location. With 600-ft. anchor arms and a 350-ft. prolongation of the south anchor arm beyond its primary anchorage, the main structure becomes 2,750 ft. long. There would be approaches totaling 2,975 ft. in length, consisting of plate-girder spans 50 to 100 ft. long and deck truss spans of 125 ft., making the total length of the structure 5,725 ft. between abutments.

As shown by the adjoining elevation of the recommended design, the cantilever has unusual outline. The lower chord of the main span is laid out in the form of a flat segmental arch appearing to spring from the main piers. The suspended span is of crescent form and rises above the roadway, whereas the cantilever and anchor arms are kept below the roadway and have horizontal top chords. The lower-chord line of the anchor arm is made similar to the line of the half main span. The suspended span is 450 ft. long and the cantilever arms each 375 ft.

Triangular Truss Construction—Deck construction is adopted in order to reduce the weight of the floor framing.

A study has been made utilizing in these deck cantilever trusses four relatively light trusses side by side with a 7-in. slab of reinforced concrete for a floor carried between the upper chords. Light trussed floorbeams extending between the top chords at frequent intervals will give support to this floor slab and form part of the system of lateral bracing. The top plates in the chords themselves are to be protected by a thinner concrete slab. It is suggested that the lower chords of each pair of these four trusses be combined into a single member of correspondingly larger and more efficient section, possibly hexagonal in shape. The various members of the web system could converge to these lower chords forming two triangular shaped units as part of the swaybracing system. On the contrary, at the main piers the vertical posts and the principal diagonals might well flare outward, forming a tower-like structure with greater stability, at the same time distributing the loading to several points on the masonry of the pier. This adaptation of the trusses eliminates the cost of a separate tower between the pier and the grade of the road, as well as materially reducing the size of the pier base that would be required for stability if the structure lay wholly above the plane of the roadway. Connection between the members will be somewhat complicated, but may be a development of bent steel plates, pressed steel forms, light steel castings or a combination of all.

The deck is to consist of a 40-ft. roadway and two 7-ft. sidewalks bracketed from the main floor system and separated from the roadway by a concrete collision curb high enough to keep any wheel from mounting the sidewalk grade. This width, the commission says, will easily take care of traffic for some time to come. Provision can be made to enable the bridge to be strengthened later on and a lower floor to be added, to carry either vehicles or railway tracks. "The V-shaped design of the truss system is particularly adapted to carrying railroad tracks below the floor at a minimum of expense, if provision is made for adding plates to take care of the increased loading. The factor of safety, however, may take care of this extra loading without any such additional construction, if future designers decide this procedure to be advisable."



WEST ELEVATION OF PROPOSED MOUNT HOPE BAY CANTILEVER BRIDGE BETWEEN MAINLAND AND ISLAND OF RHODE ISLAND

Traffic and Amortization by Tolls—There is one bridge connecting the island with the mainland, Tiverton Stone Bridge, crossing the Sakonnet River east of Portsmouth. The traffic over this bridge (1,800,000 vehicles in 1925) is taken to be a close indication of the traffic which would use Mount Hope bridge were it now in service. The commission therefore estimates that in 1925 the Mount Hope bridge would have carried at least 1,000,000 cars. Projecting this estimate along a line asymptotic to the curve of Rhode Island motor vehicle registration (roughly 100,000 in 1925), the expected Mount Hope bridge traffic is set by the commission as 2,000,000 in 1934, 3,000,000 per year in 1941, etc., figures which represent rates of increase of 8 per cent per year between 1926 and 1935, 6 per cent between 1936 and 1940, and 4 per cent per year between 1941 and 1945, reaching 3,500,000 vehicles per year in 1945. These rates of increase are very much lower than those over Stone Bridge and other focal points of traffic in the vicinity.

With this heavy traffic, the cost of the structure (estimated at $6,000,000, including land damages, engineering, and interest during construction) can be amortized on quite moderate toll rates within periods ranging from 10 to 20 years. An average toll rate of 50c. per vehicle would retire the bonds in nine years, besides paying interest and operating costs (operation and maintenance estimated at $25,000 to $30,000 per year). A 30c. rate would retire the bonds in 14 years. A rate of 50c. for the first 5 years and 25c. thereafter would retire the bonds in 12 years.

Herbert W. Smith is chairman and Arthur A. Sherman secretary of the Mount Hope Toll Bridge Commission. Daniel O. Cargill is engineer, succeeding Clarence L. Hussey, who died two months ago.

Records on a Concrete Road Using Weighed Aggregates

Weighing Simple and Rapid—Daily Sieve Analysis Aggregate Moisture Content Tested Often—Full Test Control

By W. E. Barker
Highways Bureau, Portland Cement Association, Chicago, Ill.

With the increased knowledge of concrete which experimental work has given us in the past few years, has come a realization that more exact methods of proportioning were needed. This is true because volumetric measurement of loose materials is subject to small inaccuracies. These are increased by the bulking of damp sand, until the variation in proportions from batch to batch and from day to day may result in concrete of widely different strengths and consistencies. Measuring aggregates by weight so reduces these variations that individual batches will not differ by a hatful of material, while the strength of the resulting concrete is more uniform. In spite of that, however, many construction men, both among engineers and contractors, believe that weighing aggregate is impracticable—that it will not work on actual construction. Experience in Iowa proves just the contrary. It not only works, but works to the advantage of both engineer and contractor, as a description of a typical job will show.

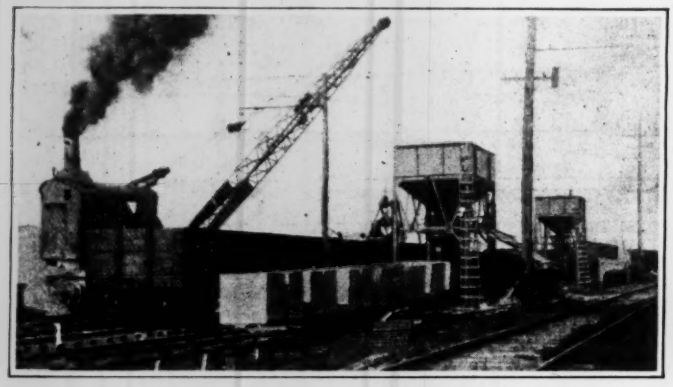


FIG. 1—CENTRAL PROPORTIONING PLANT WITH SEPARATED SAND AND STONE BINS

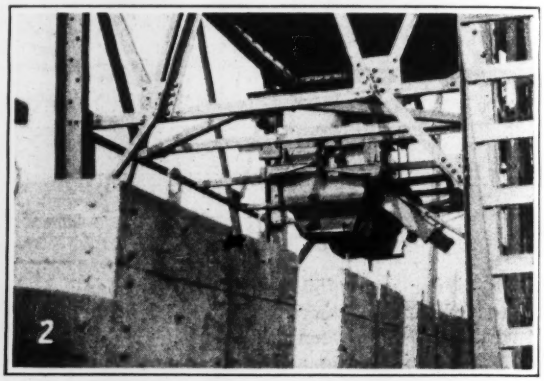


FIG. 2—WEIGHING BOXES HUNG CLOSE TO BATCH BOX TOPS

The construction selected as typical of the work done in Iowa since 1923 is in Scott County, where 15 miles of primary road is being surfaced with an 18-ft. concrete pavement. Materials are proportioned at the central plant and hauled to the mixer, which is on the subgrade, in 10-car, 20-batch industrial trains. Four trains are needed to keep the mixer busy.

Aggregate is brought to the proportioning plant over an interurban railway and is unloaded from cars to storage piles by a 25-ton railway crane with 50-ft. boom and 1¼-cu.yd. bucket, which also keep the bins filled.

There are two storage bins, Fig. 1, one for sand and one for stone. Under each bin, with just headroom enough for the industrial trains to pass beneath, there are two measuring boxes, Fig. 2. Each of these boxes is hung on the short end of a scale beam while from the other end of the beam a long rod hangs down to within convenient reach of the scale man. On this long rod the weights are placed which balance the load in the measuring box. The rod also carries a pointer which indicates when the scale beam is balanced. The flow of materials from bin to measuring box is controlled by a sliding plate valve actuated by a long lever which hangs down beside the weight rod.

An empty industrial train stops first at the sand bin where two men weigh the sand—one of each measuring box, so that the two batch boxes on each industrial car may be loaded simultaneously. Before the valve between bin and measuring box is opened the scale man removes some of the smaller weights from the rod, so that the scale may be roughly balanced with about 25 lb. less than the required amount of sand. The valve is opened and the measuring box filled rapidly till the scale beam rises. When that occurs the smaller weights are replaced on the rod and small amounts of sand are allowed to run into the box by working the valve back and forth, opening it slightly and closing it again, until the scale beam just balances. The whole operation is so rapid that two experienced scale men can weigh the sand for one car (two batches) in the time it takes to spot the car beneath the boxes. If an excess of sand gets into the measuring box it is run out through a chute provided for that purpose.

When all the cars have been loaded with sand, the train and scale men move to the stone bin where batches of pebbles are weighed in the same manner, except that the beam is roughly balanced with about 50 lb. less than its final load before all the weights are placed on the weight rod.

The average time required to load a train, including cement, is 15 minutes. As of Aug. 11, 1925, with 5.88 miles of pavement completed, the maximum output in any one 10-hour day has been 380 batches, though the capacity of the plant, working at top speed, but allowing the necessary switching time, is estimated at between 600 and 700 batches, or sufficient material for 1,680 cu.yd. of concrete.

The plant inspector, who is an engineer and a regular member of the State Highway Commission forces, controls the weight of material put in each batch. The specifications give the proportions of materials in pounds —1 lb. of cement to 1.71 lb. of fine aggregate and 3.47 lb. of pebbles. That means that each 6-sack batch contains 964 lb. of dry sand and 1,957 lb. of dry pebbles. The moisture in both sand and pebbles is determined at frequent intervals—as often as every 30 minutes for the sand when there is much variation—and the weight of moisture in each is included in the total weight of each batch.

Each day the plant inspector makes a sieve analysis

of the aggregate, using a full set of test sieves sized from 2½-in. to 100-mesh. Four times a day both sand and pebbles are tested with the No. 4 sieve. Particles in the sand which are retained on the No. 4 sieve are called coarse aggregate. Particles in the pebbles passing the same sieve are designated fine aggregate. Then the batch weight of each material is adjusted so that each batch contains the correct amount of fine and coarse aggregate.

No change is made in the batch weights already in use, because of moisture tests or sieve analyses, unless a change of 5 lb. or more is required. Scale men are allowed a maximum variation of 5 lb. from the true weight, making the possible error 10 lb. per 2,900 lb., or a possible variation between batches of only .35 per cent. At least once a day the scales are checked by hanging standard iron weights on the measuring boxes, Fig. 3, and many times a day the scale beam is checked for balance at zero load.

FIG. 3—WEIGHING DEVICE CALIBRATED DAILY WITH STANDARD WEIGHTS

The inspector at the mixer makes one slump test per day and at the same time, from the same batch of concrete, casts two 6x12-in. cylinders, Fig. 4, which are sent to the state laboratory for test in compression. Once a day he washes all the cement from a sample of concrete and sends the residual sand and pebbles to the plant inspector, who dries the sample and separates fine and coarse material with a No. 4 sieve. This is done as a check on the accuracy of the proportioning. The sample should be 33⅓ per cent sand. It actually varies from 29.5 per cent to 35.3 per cent, the average variation being 1.5 per cent. On work done in 1923 when materials were measured by volume, the maximum variation on 7 jobs was 21 per cent, minimum 7 per cent, average 13.4 per cent.

As a check upon the amount of mixing water used, a sample of concrete is taken once a day and sent to the plant inspector in a covered tin pail. The plant inspector weights the wet sample, dries it, and by weighing the dried material determines the water it contained. According to these tests, mixing water has varied from 6 to 7 per cent of the concrete, by weight.

Although cement content is affected by other things, such as the correct elevation of the subgrade, the compaction of the concrete, and the voids in the stone, the cement actually used as compared with the amount of cement theoretically required is a good indication of the efficiency of proportioning by weight. The check is made at the end of each day's run. The daily reports show a maximum shortage of 1.0 per cent and a maximum over-run of 3.6 per cent. The average for the whole job, to date, is an over-run of 0.7 per cent. On 41 construction jobs during the period from 1920 to 1923, when aggregates were measured by volume, the average maximum over-run in cement for a season's work on one job was 7.22 per cent, the minimum was an under-run of 0.65 per cent, and the average over-run for all jobs was 2 per cent. With close inspection the pavement slab will always average a little thicker than specified, and a slight over-run is to be expected, but the reduction in this over-run which has been made by weighing aggregate is a direct saving to the contractor —a saving of about 52 bbl. of cement per mile on this job as compared with the average of the 41 jobs.

FIG. 4—SLUMP TEST AND TWO COMPRESSIONS CYLINDERS MADE DAILY

Results of the compression tests made on the 6x12-in. cylinders indicate a considerably more uniform concrete than was secured with volume measurement. As strength is more concerned with the ratio of quantity of mixing water to quantity of cement it is probable that weighing materials has increased this uniformity by making it possible to keep the consistency uniform. Since uniform consistency is also essential to a smooth-riding surface, it is not surprising that the 1924 and 1925 pavements ride better than any built previously.

Except for the first cost of the scale, there is no additional expense connected with weighing aggregate. The same plant crew is required as for volume measurement, the men and their occupations being as follows:

Men	Occupation	Men	Occupation
1	Craneman	7	Cement handlers
1	Crane fireman	2	Scalemen
2	Clean cars for crane	1	Cleans and bales cement sacks

From every point of view measuring batches of aggregate by weight seems superior to volume measurement.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

ARKANSAS RIVER BRIDGE, LITTLE ROCK, ARK.

Little Rock, Ark.

STATE CAPITAL AND LARGEST CITY of Arkansas, situated on the Arkansas River, 128 miles southwest of Memphis. The city is built on a rocky bluff, fifty feet above the river, which is spanned at this point by two railroad bridges and one county bridge. Three railroads have shops and terminals in the city. Trade by river and rail is extensive. Cotton, lumber, bauxite ore, and agricultural produce are shipped in large quantities to all parts of the country. Cotton gins and presses, furniture, staves, brick and tile are the principle manufactures. Granite is quarried just outside of the city. Little Rock is the seat of the Law and Medical Colleges of the University of Arkansas It was incorporated, and made the seat of the territorial government, in 1831, with a population of 500. Because of its facilities, this city was a point of contention during the Civil War, and was captured by federal forces under General Steele in 1863. The present population is about 70,000.

THE job of city engineer in any Arkansas municipality presents conditions unique among American cities. There is a constitutional barrier—a relic of post-Civil War carpet-bag days—against the issuance of bonds by state, county and municipality for public improvements. Just what this legislative blind spot has done to complicate the advance in municipal engineering in the state merits particular attention. The outstanding fact is that it has entirely changed the character of the city engineer's position from that which is usually encountered. It has made of him not the technical director of new construction but almost entirely a supervisor of maintenance of varied engineering structures, built entirely without his technical advice.

The restrictive legislation, which has survived several generations but which it is hoped may be abrogated either during the current year or next, has resulted in the improvement district plan for constructing all engineering services, and under this plan all new street, sewer, and sidewalk work is done. Though the city engineer's actual influence extends only to approving of grades for new work, after construction is finished it is turned over to him to maintain. New construction as a result is very spotty, covers a wide range of excellence or the lack of it, and imposes on the city engineer the task of pacifying a population for conditions he has no part in creating.

In order to put new construction under way, a petition is circulated among the owners of property to be benefited. When a majority of the valuation of the benefited property is represented among petition signers, the petition is submitted to the city council. Some public notice is given the project and complaints are awaited. After a time, a second petition is submitted to council signed by a majority of the property owners who recommend the appointment of certain among their number as commissioners to supervise the project under consideration. These commissioners select their own assessor of that improvement district, but it is necessary that he be approved by the city council. The assessments also have to be approved by council. The commissioners choose their own engineer and attorney. Money for such work is obtained by bonds issued up to 50 per cent of the assessed valuation of the property benefited. In some cases, sufficient money cannot be secured for the improvement by the formation of one district, so two districts covering practically the same physical boundaries and improvements are formed.

There are two obvious disadvantages to public works construction under the improvement district plan. The first of these is that the city engineering office has no control over the character of services which are to be installed. Thus there is no uniformity in pavement types or quality of work done. Seldom is the city engineer consulted by the engineer of the improvement district and the city engineer has no constitutional right to interfere. But he must take the finished product and do his best to maintain it properly and at smallest expense.

The second disadvantage lies in the time and expense involved in formation and administration of improvement districts. In addition to these two principal disadvantages, the city engineer must correlate all the engineering data from numerous improvement district engineer offices for his own maintenance uses.

As a result of the more or less haphazard fashion in which new structures are built, and because this haphazard construction results in involved maintenance problems, the job of city engineer in Little Rock is one wherein grief prevails.

As an indication of the inadequacy of engineering structures, the business section, comprising approximately 1 sq.mi. of area, is served almost entirely with 8-in. sewer pipe with 10-in. outfalls to the river. The outfall sizes, the city engineer estimates, should be at least 48 or 52 in. But the cost of an adequate system which would look to the future growth of the city is so large that the direct property benefited cannot stand it. It is just possible that an improvement district, including practically the entire city, may yet have to be formed to give the city adequate sewerage facilities.

Many years ago an 8-ft. brick arch was built over a natural waterway to care for storm water. Eventually numerous small sanitary services were led into this outfall. This brick arch had no floor and inasmuch as it is close to half a century old, it is at the point where it is a constant source of costly maintenance and danger. The odor is very bad and at times of excessive rain cave-ins anywhere along its length are possible. One had occurred a few days previous to the visit made to Little Rock by one of the members of the *Engineering News-Record* staff. The 8-ft. sewer had been running full of storm water with a large content of sanitary sewage. As a result, the arch disintegrated at that particular point, the caving occurred taking with it a circle of pavement probably 60 ft. in diameter. Due to the succeeding wash, this hole was enlarged, endangering nearby railroad property. As there was not sufficient money in the maintenance fund

to reconstruct this section, the railroad company agreed to share the expense. It is this kind of work which the city engineer is called upon largely to do. After a rain or during the course of a rain, it is probable that the city engineer will get from 25 to 40 personal calls a day at his office from householders and business concerns complaining of the condition of the sewerage facilities.

In addition to this downtown sewer condition, one almost equally bad is to be found in Pulaski Heights, which is a residential section. The Heights are covered almost entirely with septic tanks. However, an improvement district is planned to put in new and adequate services there.

As an indication of the heterogeneity of paving in Little Rock, during 1925 the following types were laid: 6-in. plain concrete, 25,000 yd.; 7-in. gravel, 22,590 yd.; sheet asphalt (1½-in. binder and 1½-in. top on 6-in. plain concrete base), 28,631 sq.yd.; bitulithic (2-in. surface laid on both 4- and 5-in. concrete base), 40,869 sq.yd. In addition, the city itself laid a small amount of brick on a 6-in. concrete base which replaced worn-out wood block. This was laid by the city because the brick were furnished by a brick concern gratis.

Up to 1924 there had been laid the following mileages of various types: Sheet asphalt, 15.2 miles; bitulithic, 26.52 miles; macadam, 10.27 miles; concrete, 10.67 miles; brick, 7.18 miles; wood block, 6.45 miles; gravel, 9.08 miles; tarvia, 2.21 miles, and other asphaltic paving, 1.33 miles. This is approximately 124 miles of improved street work, of which a large percentage is classed as permanent or semi-permanent. It is obvious what a difficult job the city engineer has to maintain the streets. As a matter of fact, a number of streets have got to the point where replacement is necessary. As replacement is considered a maintenance job, some streets which are urgently in need of reconstruction cannot be touched at all because of the excessive maintenance cost and the lack of money with which to do the work. To repair its asphalt type streets, the city contemplates the purchase of an asphalt plant. As it stands now, the city finds it more expensive to put down resurfacing itself than to do it by contract.

As the Arkansas River flows through Little Rock, the construction of bridges is also a considerable problem. In the construction of the newer bridges the entire city of Little Rock has been formed into an improvement district. Competent engineering has been sought on the bridge work. Daniel B. Luten built the Main St. bridge and Ira G. Hedrick designed and superintended the construction of the Broadway bridge. Both of these are reinforced-concrete structures.

The mayor and council form of political organization obtains in Little Rock. All engineering work is under a street committee of nine councilmen, one from each ward. The engineer, the present incumbent being E. E. Stansberry, is appointed by the mayor. Inasmuch as he has no connection with new construction, his chief task is sewer maintenance and street reconstruction.

Garbage disposal is under a superintendent of streets and sanitation. Garbage is dumped into the Arkansas River. An incinerator has been used at odd times, but has been found to be inadequate, and studies are now being made for better garbage disposal. Late last year the entire city official family visited St. Louis to study garbage incineration. Some attempt is made at separation of garbage from refuse, but the attempts have borne little fruit. It is impossible to get white persons to drive the garbage wagons and inasmuch as enforcement of any regulation at separation of garbage from refuse is up to the drivers, the white population is slow to accede to any of the requests which the black garbage wagon drivers make. The trucks used for collection are all motorized, each of the eight carries four loads daily. In the watermelon season the capacity of the equipment is overtaxed as the amount of garbage collected is almost double that during the rest of the year. This collection is only for householders, office buildings, commercial houses, etc. There is a requirement that every place which is operated for profit must dispose of its own garbage. That includes hotels, restaurants, and like places.

Street cleaning is done with motorized equipment supplemented by hand sweepers who usually are city prisoners. The chain gang is used almost altogether for that. The commercial district is swept every night, and there is no flushing.

In sidewalk construction there are two methods of procedure. Either an improvement district is formed or the city blocks off portions which must be improved where lack of improvement constitutes a public nuisance or danger. A year and two months are allowed to elapse after the first public notice is posted, before construction becomes compulsory. Usually, to avoid any friction, the city has followed the practice of getting the property owners in any so-called condemned section to acquiesce in the sidewalk construction.

The position of Mr. Stansberry, therefore, is unique. It is undoubtedly true that all Arkansas cities are growing under severe physical handicaps. Mr. Stansberry, along with numerous other forward-looking men, hopes that in the very near future some financial relief will come that will allow reconstruction and new work to proceed to the degree needed. But until such time, he must submit to numerous complaints and make such makeshift repairs as his maintenance budget will allow.

An Old Campaign for Municipal Ownership

Five successive popular votes were taken at Cincinnati, Ohio, before the city acquired ownership of its water-works in 1839 from a company that put them in operation in 1821, according to an historical summary that appears in the latest published report of the Cincinati water-works. In 1824, 1832 and 1836, purchase was rejected by popular votes of 244 to 25, 617 to 303 and 1,274 to 956. The tide of public opinion turned in 1838, when, after a 20 per cent increase in rates earlier in the year, a vote of 1,573 to 521 in favor of purchase was cast. Apparently legislative sanction and another popular vote was necessary, for on March 16, 1839, a "new act was passed by the legislature and on May 3, following, the fifth and final vote was taken." This seems to have been regarded as a formality, for only 1,281 ballots were cast, of which 728 were for and 553 against purchase. The city took possession of the works on June 25, 1839, when the plant consisted of two pumping engines, a reservoir and 22½ miles of pipe—19 of wood and 3½ of iron. The first works, started up on July 3, 1821, included two sets of pumps driven by horses or oxen on a circular treadmill, lifting water to a hillside tank from which it was distributed through pipe logs of 2½-in. bore. J. A. Hiller is now superintendent of water-works and Charles F. Hornberger director of public service.

Surety Bonding Practices Officially Censured

State Architect, Investigating as a Special Commissioner, Finds Undesirable Conditions and Asks Elimination of Bonds in New York State Building Contracts

A SEVERE criticism of surety bonding practices and a recommendation that bonds be not required on New York State public building work are contained in the report of Sullivan W. Jones, state architect, as special commissioner appointed to investigate money conditions in the agencies for state building construction. On March 1, 1923, when Mr. Jones took office it was found that every contract for state buildings then under way was from two months to two years late. "On several of these contracts," says the report, "the contractors were in financial difficulty, and four were being completed by the bonding companies. From March 1, 1923, to the present time (March, 1926) only one of the more than one hundred contracts has been completed within the contract time. With a few exceptions, the contractors to whom the contracts had been awarded have proved themselves incompetent, unbusinesslike and indifferent to the reputation they earned in the Department of Architecture."

Contracts have been uniformly awarded to the lowest bidder, irrespective of his financial standing or his experience. There is no reason why these contractors should be much concerned about their records with the Department of Architecture. Under the repeated opinions of the Attorney General interpreting the law, these contractors could not be refused the award of a new contract, if they could furnish the required bond. There was only one disqualification and that was a default upon a previous contract. The penalty for nonperformance which is enforced against a contractor in the world of private business, that of being debarred from bidding again, could not be invoked by the state. Financial irresponsibility and incompetency were not necessarily sufficient reasons for rejecting a bid. The Attorney General has held consistently that the test of the low bidder's responsibility and competency was his ability to secure a surety company bond.

This situation led to an appeal to the governor for authority to investigate the conditions surrounding the securing of surety company bonds by contractors, and the standards of so-called underwriting adopted by the surety companies in "writing the business." Hearings were held in New York City and Albany. Many witnesses were examined, among whom were contractors engaged on current state construction work and others engaged in large private projects; experienced architects familiar with building conditions in the city and state of New York and with contracting practices; officers and agents of the surety companies; sub-contractors and material men and representatives of various trade associations. The minutes and recommendations of the Joint Conference on Construction Practices, the report on examination of the Towner Rating Bureau by the Insurance Department, the statement of the Boston Building Congress on contract bonds, the proceedings of the Association of State Highway Officials were examined. The procedures of the federal government and of other states in awarding contracts were studied. The correspondence between the surety companies and the Towner Rating Bureau, the books of account and records of the surety company agents, the books and estimates and worksheets of contractors and bidders on state work and the records of the state departments involved in this investigation were examined.

Conclusions—From a careful study of the evidence the following conclusions, quoted from the report, appeared justified:

1. During the past ten years bidding for state construction contracts has been progressively unsatisfactory. Generally but two or three bids are received on important contracts. Experience with a large number of contractors establishes the irresponsibility and incompetency of many of them.

2. Construction contracts awarded by the state should be regarded by reputable and competent contractors as a highly desirable class of business. The work is of the highest standard, contract terms are fair and equitable, and payments are prompt.

3. Among the better class of contractors there exists a prejudice against state construction contracts. Only occasionally have such contractors submitted bids. They complain that they are obliged to compete with irresponsible and incompetent contractors who bid low because of mistakes, inexperience and carelessness.

4. Good building construction results only from the employment of competent contractors and fair prices paid. Unless the price is fair either the building suffers, or, if inspection is rigid, the contractor is forced into financial difficulty. Good building is economical in the long run and may be obtained only by using competent contractors working at fair prices. Unfit contractors and too low prices make for waste.

5. In connection with public work, officials are often unjustly condemned if a low bidder does not receive the award. Growing out of fear of this sort of criticism, the common practice has been adopted of awarding to the lowest bidder regardless of other equally important qualifications. As a consequence, very often a contract is let to a contractor not competent to produce proper results.

6. Protracted delay has become a recognized characteristic of the execution of state contracts. This condition is due in the main to the incompetency of the contractors.

7. The law requires the successful bidder to furnish a surety company bond for the due performance of the contract. Contractors of inferior ability are able to get contracts for important work who, presumably, would not be entrusted with the work if they could not furnish a bond. This fact discourages competent contractors from bidding.

8. Bidders are required, under the law, to deposit with their bid 5 per cent of the amount thereof. Agents representing surety companies have advanced moneys or lent their credit to bidders to enable them to make the necessary deposits with their bids as an inducement to secure the writing of the bond. This is a violation of Section 65 of the Insurance Law.

9. The provision of the law requiring the giving of the aforesaid bond does not protect the state from incompetent and irresponsible bidders, but, on the contrary, makes it possible for such bidders to obtain contracts and exposes the state to hardships and delays in the execution and completion of contracts.

Notwithstanding reinsurance, that is, the division of the risk among two or more surety companies, required by law on bonds in penal sums of any considerable amount, and notwithstanding the assumed and legalized pooling of experience in the rating agency, and notwithstanding the uniform rate charged, there is no uniformity in the underwriting methods followed by the surety companies, or even by a single company in writing any two risks. The keen competition for business has tended to lower the standards for determining the hazard. In many instances the judgment of the agent is accepted without question.

Many contractors with inadequate financial resources and lacking requisite experience and organization are able to secure bonds on almost any contract they may desire to undertake. If surety companies have suffered losses they may trace the causes back to their own lax methods of underwriting.

10. The state pays to the contractors at the time of the first payment on a contract 85 per cent of the amount of the premium paid by the contractor for the bond. The Department of Architecture requires the contractors in making an application for first payment to annex a receipted bill showing the payment of the premium on the bond. These receipts have been issued promiscuously by agents of surety companies and in some instances by the surety company, when no payment has been made.

11. The state was unable to award an important contract to a competent bidder because of the refusal of the surety companies to write the bond. This caused an actual loss to the state of $309,000, and a delay of about three months.

12. The present form of contract and methods employed by the state department of architecture in making payments sufficiently protect the state in the event of the failure of the contractor to complete his work. Under the circumstances the bond may be dispensed with as an added and unnecessary expense. The bond does not serve any useful purpose; it does not even protect sub-contractors or material men.

13. The rate charged on state construction contract bonds is 2 per cent of the total contract price for the period of two years, although the penal sum stipulated in the bond is one-half of the contract price. The rate charged for municipal construction contract bonds is 0.75 per cent for one year; for federal and private construction bonds the rate is 1½ per cent for two years. There is no justification for the charge of 2 per cent to the state, for the ultimate liability of the surety company is the same in each instance.

14. The commissions allowed by surety companies to agents who procure the business of writing bonds is inordinately high, ranging from 30 to 40 per cent of the premium. These large commissions are the result of the competitive conditions. They have led to such avidity for business that wide excesses are the rule, while increasing premium rates for bonds have enabled the surety companies to assume over greater risks until the bond serves to furnish irresponsible contractors for state work rather than to protect the state against them.

The records of the department show that the premium rate on bonds from 1908 to 1912 inclusive was 0.5 per cent for one year. From 1913 to 1916 inclusive the premium rate on bonds was 1 per cent for two years minimum. From 1917 to 1918 inclusive the premium rate on bonds was 1½ per cent for two years minimum; and from 1919 to the present time the rate has been 2 per cent for two years minimum. These rates have been arbitrarily fixed, and have no actuarial basis.

15. It is common practice for agents in endeavoring to procure the writing of these bonds to make false representations and statements as to their ability to do and perform acts which might aid the contractor, and to exercise influence with state officials.

16. The premium on the bond is added to the bid and paid by the state, and generally the contractor includes in his bid a profit on the premium.

17. At present premium rates, if the bond were eliminated, the state would save in premiums during the next three years approximately $1,190,000 and during the seven years following, on bond money projects alone, approximately $1,160,000. From 1908 to 1925, inclusive, the total premiums paid by the state amounted to $924,180. During this eighteen-year period, the losses sustained by the surety companies was approximately $141,000.

18. It is not customary in awarding contracts on private work to require a bond. Eminent architects and contractors who have successfully prosecuted important work are in agreement that if reasonable precautions are exercised in the selection of contractors, the surety bond is an incubus on the building industry and an unwarranted expense to the community. It encourages the tendency on the part of public officials to rely upon a contract bond rather than determine for themselves the real responsibility and competency of a contractor.

19. The purpose of requiring bonds to be furnished by contractors is to insure the state against loss by reason of defaults and if the purpose of insurance is to secure a widespread distribution of losses, then the state has not profited by its insurance against default. There can be no better agency for distributing losses more economically, or more widely, or more equitably, than the tax levy.

The state owns buildings valued at between $400,000,000 and $500,000,000. On them it carries no fire insurance. There have been many fires, some involving serious losses. Had insurance against loss by fire been carried by the state, it would have paid out in premiums an amount many millions of dollars in excess of its actual losses. When the insured has resources and can distribute losses, self-insurance pays substantial returns, as has been amply demonstrated under the Workmen's Compensation Law and the operation of the State Fund.

Recommendations—These recommendations are offered as a means of meeting the situation:

1. That Section 38 of Chapter 58 of the Laws of 1909, known as the Finance Law, and Section 14 of Chapter 48 of the Laws of 1909, known as Public Buildings Law, be amended to eliminate the requirement that a contractor furnish a bond.

2. That the word "responsible" as used to qualify contractors under Section 14 of the Public Buildings Law, be defined by statute as meaning that the contractor shall be able to show assets in excess of liabilities to the equivalent of 15 per cent of the amount of the contract, or that a bank licensed to do business in the State of New York will advance him credit to that amount, and that he shall be able to show he has successfully executed work of similar character and scope.

3. That said Section 14 of the Public Buildings Law be amended to require a contractor, in order to qualify for an award of contract to prove his responsibility, as defined by the amendment proposed under the second recommendation, to the satisfaction of the State Architect and that Section 1293-b of the Penal Law be amended to include the giving of a false statement to any state department or official.

4. That said Section 14 of the Public Buildings Law be amended by adding thereto a provision requiring that all contracts contain a clause providing for the collection of liquidated damages in the event of the failure of the contractor to complete a contract within the time specified.

5. That said Section 14 of the Public Buildings Law be amended to provide that in the event of a bidder failing to execute the contract which has been awarded to him, that the sum deposited by such bidder be forfeited as liquidated damages and the board, department, commissioner or officer receiving said deposit shall forthwith deposit the same with the treasurer of the state.

6. That legislation be enacted authorizing the State Architect to issue a subpoena to any and all bidders, their agents, servants and employees and to interrogate them with respect to any bid submitted by them and to compel the production of any and all books or records necessary for the conduct of such examination.

7. That the form of contract used by the State Architect be changed to provide for progressively diminishing retained percentages on payments made as the work advances and the state's exposure to loss diminishes, beginning with a retention of 20 per cent on the first payment and decreasing proportionately as the work progresses to 5 per cent on the last payment previous to the final payment, which signifies acceptance of the work.

Two More Nile River Dams to Be Built

The Egyptian Council of Ministers, some months ago, opened a credit totaling $25,000,000 for the construction of two dams across the Nile River, according to the Department of Commerce. Of this sum, $15,000,000 is for the construction of a dam across the White Nile at Gebel Aulia, about 50 miles south of Khartoum, and the balance for the building of a barrage at Nag Hamadi, north of Aswan in Upper Egypt. Work on the latter will probably start this year, but work on the Gebel Aulia dam which was started some years ago and then dropped, starts July, 1926, or as late as February, 1927.

Some of the Tuning-Up Difficulties of the Milwaukee Sewage Plant

Fundamentals of Activated-Sludge Process Sound —Troubles Mechanical, Conveyors Clog with Cake—Pumps Break Floc

By T. Chalkley Hatton
Chief Engineer Sewerage Commission, Milwaukee, Wis.

In "tuning up" a plant involving a large amount of machinery there is always a certain amount of adjustment required. When the plant breaks precedent as to type and pioneering in the design is required, more details are found that need painstaking adjustment and even changes that could not be foreseen in small-scale experiments. The Milwaukee sewage-works are now having that experience. All troubles so far have been found to be mechanical and not fundamental. These difficulties are gradually being eliminated. The conveyor system for sludge handling, which is larger and more elaborate than that of any industrial plant in Wisconsin, has given the most trouble but that is not to be wondered at since except at Houston, Texas, where trouble was also had, no conveyor system has ever yet been called on to handle this product. Some of the early difficulties and what is being done to overcome them are noted in the following article by Mr. Hatton, chief engineer, who states that he and his staff are working out of the dewatering plant difficulties day by day with no doubt as to final success. —Editor.

A BREAK in the pump main of the Milwaukee sewage-works on Dec. 28, 1925, at 10:30 p.m. consisted of a complete fracture of a 48-in. cast-iron main which carried the low-level sewage from the pumps to the high-level conduit. The break was evidently caused by a slight settlement of the north wall of the power house under, but not through, which this main passed. It was but a few inches outside the wall of the pump well and in a difficult place to get at. A new casting was made and in place in ten days.

The plant had been successfully and continuously treating about 70 m.g.d. of sewage from June 26, 1925, until Dec. 28. As soon as the break occurred all the sewage reaching the plant was turned back into the rivers where it had originally been discharged. Five days afterward the sewage from the East Side high-level intercepter, amounting to 25 m.g.d., was turned back into the plant and at this rate has been running through continuously with most excellent results.

Conveyors Changed—On Nov. 2, before the conveyor system was completed, we started up the dewatering plant, the filters working very satisfactorily, but it was apparent from the start that some changes had to be made in the conveyors. We ran on for two or more weeks making almost daily changes in the conveyors, when we had to shut down for a week or ten days to put in a new type of conveyor.

When we attempted to start up again the filters would not produce a cake. For two to three weeks we were engaged in running down the cause of the filter failure; at the end of this time we decided the trouble was in the type of sludge pump we were using, plus the condition of the very cold sludge.

Sludge Pumps Break Floc—The pumps installed were of the closed-impeller centrifugal constant-speed motor-driven type running at 1,700 r.p.m. each of 1,500 g.p.m. capacity. First we changed the rotor, making it variable speed, without success; then from closed to open impeller, still without success. Then we installed a temporary "stuff" pump of the ball-valve type and this removed the difficulty, the sludge reaching the filters in the same condition as it left the acidification tank. Trouble arose, since, with cold sludge the centrifugal pumps destroyed the sludge floc so that it could not be filtered. To overcome this trouble we have purchased, and will install within the next sixty days, three "stuff" pumps of the ball-valve type.

Since the installation of the temporary "stuff" pumps the filters have been working daily and in a very satisfactory manner producing a cake from $\frac{3}{2}$ to $\frac{1}{4}$ in. thick. We are now trying to cut down this production in order to get dryer cake, as the thicker the cake the wetter it is. It now runs from 82 to 84 per cent moisture, we are seeking 80 per cent moisture.

Wet Cake Clogs Conveyors—The dryers were designed to receive the wet cake having a moisture of less than

FIRST CARLOAD SHIPMENT OF THE PRODUCT OF THE MILWAUKEE ACTIVATED-SLUDGE PLANT

One of three cars shipped from the Milwaukee sewage disposal plant Feb. 10. Two cars have been shipped each week since that date. Production is gradually being increased. The trade name, "Milorganite," was chosen from a list secured by competition.

65 per cent. To procure this it is necessary to mix dry sludge with the wet cake before it reaches the feed end of the dryer. For this purpose the conveyor system carrying the wet cake and mixing it was designed of the spiral ribbon type of such capacity, so far as the data were available, to carry 100 per cent overload.

It was found that not one of these wet-cake conveyors had either the power or shape properly to convey the amount of material of this character required. The motor capacities were increased and solid flight conveyors were tried in place of the ribbons; also the type of hangers was changed but with unsatisfactory results, although each change bettered the operation.

It was seen that as the wet cake and dry material were mixed together, the resultant mixture was ideal for a short distance, but beyond this distance the mixture began to knead up like bread dough and by the time it had traveled 60 or 70 ft., as it had to do to reach the feed end of the dryer, it was in large pieces quite unfit to go into the dryer.

It is now apparent, after the many long experiments we have conducted with this system, that we are war-

ranted in making a radical change in our wet-cake conveyors. The design for this change has been substantially completed but before putting it in we are building a test conveyor to try it out, which we hope to have ready shortly.

Dewatering Plant—For three and a half months we have been investigating the troubles experienced in the dewatering plant and we feel that we are daily getting valuable information which will enable us to smooth out these troubles satisfactorily. Changes necessary to be made in a plant of this size require time to secure materials and do the work, but none of us has any doubt as to the ultimate outcome.

While there has not been a good opportunity to make a running test of the dryers, they have been operating, at least two of them, daily (24 hours) for several weeks and have been producing satisfactory materials, although not up to quantity. This fault cannot now be attributed to the dryers because the conveyors have not been able so far to deliver the proper mixture for any length of time continuously.

On Feb. 10 we shipped out our first 100 tons of fertilizer. It is in excellent physical condition. From 5 to 7 tons of dry material was being produced daily. By the end of February, with a larger conveyor, this production was nearly doubled.

Wharf Fire Loss Laid Largely to Lack of Cross Fire Walls

New Orleans Fire Recalls Similar One in 1922 at New Orleans Army Base Where Fire Walls Proved Ineffective

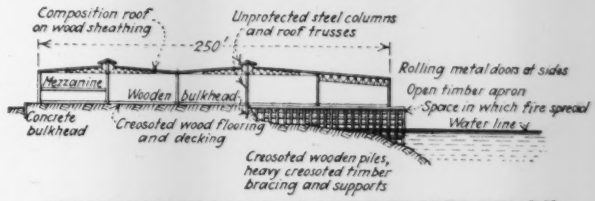
ANOTHER large wharf fire destroying two public wharves and their adjacent structures at New Orleans last November caused a loss estimated at $4,000,000. The last previous wharf fire at New Orleans occurred Sept. 15, 1922 (*Engineering News-Record*, Oct. 5, 1922, p. 555), and destroyed 2,000 ft. of wharf and buildings of the United States Army Base. The loss to buildings at that time was estimated at $3,000,000 with an equal amount lost on contents and equipment. The recent fire is described in the *Quarterly of National Fire Protective Association*, January, 1926, by Walter K. Grant, from which report this article has been abstracted.

The buildings destroyed in last November's fire contained coffee, lard, alcohol, soap, lumber and miscellaneous cargoes. They were located on the east bank of the Mississippi River and extended from the foot of Poydras St. to Notre Dame St., approximately 1,300 ft. There were no exposures of importance. The sheds were of the usual type of construction, one story high, with metal sides and ends, tar and gravel roofs on wood sheathing, this in turn being supported on unprotected steel purlins and trusses and unprotected steel columns. The floors of the sheds were mainly of wood. Where the sheds overhung the levee they were connected by an open wharf supported by the usual heavy creosoted timber and creosoted piling construction. They formed, with the open wooden wharf on the river side of the sheds, a continuous fire area without retarding walls or draft stops of any kind, either above or below the wharf deck.

At the time of the fire, the river was at a stage that brought the water level about 16 ft. below the outermost edge of the wharf and left about 10 ft. of land on the river side of the wooden bulkhead. The fire was discovered beneath the open decking, among the piles on the river side of the wooden bulkhead. The blaze soon ignited the piling and beams and joists, and was augmented by the wind that was blowing inshore and slightly downstream. A "chimney effect" beneath the flooring, caused both by the natural and induced drafts, greatly increased the temperature and caused a quick vaporization of the creosote impregnated in the wooden timbers, adding to the flames and causing them to burn through the wooden decking and get into the sheds above. The chimney effect within the sheds was greatly intensified by the closed side walls so that the fire spread with amazing rapidity, involving both structures within the space of about 30 minutes.

A concrete wall on the lower end of the last shed, particularly that portion beneath the wharf, was instrumental in retarding the spread of the fire along and beneath other wharves.

Conclusions—The fire again illustrates the need for fire-resistive construction beneath the flooring of sheds and wharves with frequent fire walls to break up the chimney effect that causes such intense heat and forces



CROSS-SECTION DIAGRAM OF DESTROYED WHARF STRUCTURE

the fire to travel with such rapidity. This is demonstrated in the action of such a wall on the lower end of the lower shed, where that portion of the ornamental façade beneath the wharf stopped the fire from spreading under other wharves.

Contemplated Improvements—It has practically been decided in rebuilding these burned sheds and wharves to adopt superior construction. The substructure of docks and flooring of the wharves where overhanging the levee will be constructed of steel columns. Girders and sway bracing will be fastened to concrete caps and struts resting on wooden piles, the tops of which will be cut off below extreme low water. Flooring, bulkhead and the wharf above will be of reinforced concrete slab construction. Sheds will be of the usual one-story type, tar and gravel roof on wood sheathing, this in turn on unprotected roof trusses, supported by unprotected steel columns. In addition, the sheds will be divided into two sections by a reinforced-concrete fire wall, with approved automatic double doors on all the openings. This wall will be located at as nearly equal distance as conditions will permit between two existing walls that are now about 2,000 ft. apart.

60-Mile Railway Started in Northern Ontario

The Spruce Falls Pulp & Paper Co. of Canada has let a contract for the construction of a 60-mile railway line from Kapuskasing, Ont., on the Canadian National Ry. northwest to Smoky Falls on the Mattagami River, where the paper company plans to build a power plant. The paper company also plans to build a 500-ton newsprint mill.

American Railway Engineering Association's Meeting

A Patent on Rail Steel—Diversity in Highway Crossing Protection—Stations and Yard Design—Economics of Grade Reduction and Automatic Signals—Railways and College Men

INCREASING attention to matters of economic importance, without lessening the attention given to more strictly technical and routine matters, was notable at the convention of the American Railway Engineering Association, held in Chicago March 9 to 11. This development marks the work of the association through its committees, but was not reflected to any extent in the convention proceedings, where constructive discussion was relatively slight. A vast amount of varied information was included in the reports presented, but much of it was simply accepted without remark. Mention of a patent on rail steel (presumably covering a particular composition) was a special feature of interest. One committee repeated its recommendation for the issue of the "Manual" in loose-leaf form, while a discussion participated in by railway men and college professors indicated that the railways in general are missing an opportunity of some importance by their failure to employ technically trained men on any regular or systematic basis.

Rails and Patent Steel—With the presentation of the report of the committee on Rail a statement was made by G. J. Ray, chief engineer of the Delaware, Lackawanna & Western R.R., with regard to a patent on rail steel granted recently to H. J. Force, chemist for that road. He explained that the railroad has nothing to do with the patent and that test rails have shown poor results. The committee stated that during the past year many contracts have been let under the new rail specifications adopted in 1925.

As to rail failures, the good record of rails rolled in 1918 has been followed by that of 1919 rails, while a further drop for the 1920 rails is expected. Studies of rail steel indicate a difference between heats in which transverse fissures occur and those in which no such failures have developed. That traffic tonnage has much to do with rail failures was suggested by Mr. Hughes (Rock Island Lines), but this view was controverted by Mr. Harding (Southern Pacific) who said that careful study had shown little evidence of such relation. Curvature and heavy axle loads are larger factors, in his opinion. Standard sections of grooved girder rails for track in paved streets were adopted; these were prepared in co-operation with the committee on Track.

Of special interest were supplements to the report of the rail committee, the first being a detailed account of extended observations on rail joints and rail battering, by Hunter McDonald, chief engineer of the Nashville, Chattanooga & St. Louis Ry. The second was a study of the steel structure in 100-lb. and 130-lb. rails of the Reading R.R.; the heavier rails were found to be softer, and as their deflection was less, owing to the deeper and stiffer section, there was excessive flow of metal due to the cold rolling action of the wheels. A study of the relation of wheel loads to rail failures, by John B. Emerson, engineer of tests for the committee, indicates that continued cold rolling under traffic, even with light loads, will produce cumulative strains in the rail head. Further supplementing the report was a statement by G. L. Moore (L. V. R.R.) outlining evidence which indicates strongly that the cause of transverse fissures is in the manufacturing process, thus refuting the position taken by Mr. Borland, of the Interstate Commerce Commission, to the effect that heavy loads are the direct cause.

In regard to the canting of rails, a rather mixed situation developed. The committee on Rail has recommended this practice, tie-plates to be used for the purpose and the inclination to be 1 in 20. But the committee on Track recommended that the rate of inclination should be left for each railway to decide, since practice varies. Professor Talbot remarked that 1 in 40 is used more extensively, and it was voted to omit all reference to the rate of inclination. The tie-plate design submitted by the latter committee, and adopted as standard, provides for both flat and inclined plates.

That the importance of the rail joint in relation to the rails, rather than as an independent device, is being more widely recognized is evident from some of the reports. The study by Hunter McDonald has been noted above, while Professor Talbot referred to the investigation of rail joints now being made by the committee on Stresses in Track and noted in *Engineering News-Record* of Jan. 28, p. 158. Investigations as to bolts and nut locks were reported by the committee on Rail and on Track, the former including specifications for both devices, which were adopted.

Ties and Ballast—Revised specifications for ties, as agreed upon in co-operation with the American Engineering Standards Committee and the tie-producers' association, were approved. In spite of the wide acceptance of the A.R.E.A. standards, there is considerable trouble due to lack of uniformity in inspection, so that ties rejected by one road are acceptable to others. This is due partly to the personal equation of individual inspectors, but the report says frankly that overgrading on certain railways is evidently the result of deliberately disregarding the specifications. Mr. Foley (Penn. R.R.) explained that this statement is based on examinations made during an extended trip by the committee. As a check, it is recommended that all ties should be marked to show for which grade they were accepted. Dating nails for all ties are recommended, to be applied at the treating plant or in the track. In addition, ties which are dressed and bored by machine should be branded to indicate the kind of wood and the rail section for which the boring is done. This report was supplemented to some extent by that of the committee on Wood Preservation, which proposed minor changes in specifications for preservatives, for preservative treatment and for tests of preservatives, now in the manual, in order to bring them up to date. Specifications were submitted for the treatment of Douglas fir, including the incising or puncturing of the surface of the timber; also for the treatment of timber used as trunking for insulated signal wires and cables, but these specifications were withdrawn at the request of the signal section of the A.R.A. As to creosote-petroleum

mixtures, efforts are being made to draft specifications for petroleum suitable for use with creosote; tests with zinc-petroleum mixtures are being continued.

Revised specifications for washed gravel, submitted by the committee on Ballast, limit the maximum size to 1½-in. instead of 2½-in. and limit the sand (passing a screen having ten mesh to the inch) to 3 per cent instead of 15 to 20 per cent, in order to exclude all sand that can be removed by reasonable commercial methods. These were adopted with little discussion and revised rules for distributing ballast and reballastings were accepted as information. The abandonment of a former design for 15-tined ballast forks was authorized, being found impossible of manufacture owing to the close ⅜-in. spacing of the tines. However, Mr. Kirkbride (Southern Pacific Ry.) expressed the opinion that it is desirable to have a fork with tines more closely spaced than the 1 to 1¼ in. in the ballast forks now generally used.

Economic Subjects—A report on the merits of ruling grades lighter than 0.4 per cent, submitted by the committee on Economics of Railway Location was warmly received. Heavy earthwork for deep cuts and high fills has sometimes been regarded as an objection to securing very light grades, but R. H. Ford (Rock Island Lines) considered that this extra cost is negligible in comparison with the economic efficiency of low grades. Furthermore, he considered that grade revision will be carried out very extensively in the near future and will help to counteract the growing competition by motor transport on highways. A condition sometimes overlooked, however, according to Mr. Coburn (Pennsylvania R.R.) is that increased train loads will reduce speeds even on the reduced grade. In regard to the location of railways to be operated by electric locomotives, the committee reported that this feature may affect the ruling grade, total curvature, length of tunnels and the location of terminal and repair facilities. This was accepted as information, although a minority report by Mr. Lavis argued against such specific conclusions.

In regard to means of increasing the traffic capacity of single track, the committee on Economics of Railway Operation reported that the installation of automatic block signals will effect this to an extent varying with the length of the division and the number of passenger trains. This method is economical, since it saves time with present traffic and gives increased earnings as traffic increases. Furthermore, it provides intangible benefits in safety, reduction in damage owing to the smaller number of freight train stops, reduction in number of engines and cars for a given business owing to the greater capacity, and also increased good will of shippers owing to the more speedy delivery of freight. From its study of the effect of double tracking, the committee concludes that increase in yard capacity will increase track capacity on the road, and that, conversely, increase in track capacity will produce increased yard capacity, since trains can be put through the yards more quickly if there is plenty of track capacity between yards. In the discussion it was suggested that the automatic block system does not always increase traffic capacity, but the committee supported its statements, and the report was accepted as information.

Principles and practice in comparing the efficiency and cost of trackwork by different gangs and on different divisions have been outlined already by the committee on Economics of Railway Labor, which now reports that it is impossible to determine a fixed unit of cost for universal application to such work. Distribution of appropriations for trackwork over the entire year, instead of concentrating them in the months of heavy traffic, has been found economical and satisfactory and should be generally adopted. It reacts also in a better distribution of the purchase of supplies and materials, with consequent equalization of employment in manufacturers' shops. Labor-saving devices have proved their advantage and economy, but there is marked need of an accurate method of keeping cost records.

Individual roads may effect material economy by reducing and simplifying the forms used in the engineering and maintenance-of-way departments, but the varied types of organizations make it impracticable to prepare a uniform series, according to the committee on Records and Accounts. Savings of 10 to 25 per cent in cost of forms have been effected by careful study in some cases, and such a study on the Southern Pacific Ry. resulted in discontinuing 44 per cent of the forms. In regard to the proposed daily reports of time on maintenance work, the committee stated that the cost of the few clerical operations additional to those required by the Interstate Commerce Commission's accounts is small in comparison with the value of the resulting unit cost data. Discussion brought out that both the Pennsylvania R.R. and the Baltimore & Ohio R.R. are using such detailed forms as the committee has suggested and are getting satisfactory results in comparing figures from various divisions and distributing these comparisons to the division engineers. Mr. Brumley (Illinois Central R.R.) pointed out that this matter of records involves both engineering and accounting and may involve the legal side of railway operation. This report was accepted after brief discussion.

Highway Crossings and Signs—A proposed standard design of highway crossing sign, submitted by the committee on Signs, Fences and Crossings, was accepted, but on motion of Mr. Baldridge (Santa Fé Ry.) the committee was instructed to consider the advisability of requiring each sign to have a board showing the number of tracks to be crossed. The purpose of this is to reduce accidents which occur from vehicles starting over a crossing when a train has passed and then being struck by another train. The sign itself, as adopted, is of the cross-buck type, having arms 6 ft. long set at an angle of 50 deg. with each other on a post painted with black and white diagonal stripes. For states having laws which require highway vehicles to come to a stop at the crossing, the post would also carry a board lettered "Stop, State Law"; above this, in Mr. Baldridge's opinion, should be the board giving number of tracks. On the post for an automatic crossing signal, the boards would be 4 ft. long and at 90 deg.; to avoid interference with traffic where the signal is placed in the middle of the highway. A report on the elimination of highway crossings outlined designs for overhead and subway construction.

Crossing signs and protection were reported upon also by the committee on Signals and Interlocking. The need of action to secure uniformity in location as well as in design of signals for highway crossings is illustrated by the fact that the adjacent states of Pennsylvania and New York require such signals to be located

at the side of the road and middle of road respectively. A useful part of this report was a list of the advantages and disadvantages of these alternative arrangements. Another aspect of the situation, noted by Mr. Wiegand (New York Central R.R.) is that while this association and the American Engineering Standards Committee desire a red traffic "stop" sign with white letters, the highway associations prefer a yellow sign with black letters. Requisites for crossing signals were adopted, following their adoption by the Signal section of the American Railway Association.

Revised specifications for bituminous paving of highway crossings were adopted as submitted by the committee on Track, which also gave information regarding the use of natural rock asphalt by several railroads.

Stations and Shops—Joint operation of passenger terminals was the subject of a preliminary report by the committee on Yards and Terminals, accompanied by particulars of 37 such terminals, 24 of which are separately managed by terminal companies. Fundamental considerations to be observed in freight yard design, with a view to economies in operation, and a report on mechanical means for controlling the gravity movement of cars in hump switching yards by means of sliding skates and fixed track brakes, were accepted as information.

General conclusions on the layouts for engine terminals and passenger car repair shops, submitted by the committee on Shops and Locomotive Terminals, were adopted for the "Manual," as were those for the ventilation of engine houses, while a report on storehouses for shops and engine terminals was accepted as information. These subjects received no discussion.

Concrete and Building Materials—The only subject presented by the committee on Masonry was a review of the report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, suggesting certain points which the committee considers as departures from established practice on which adequate supporting data have not been given. The committee recommends that the A.R.E.A. specifications should be followed in including slag as aggregate and in excluding both twisted bars and rail-steel bars for reinforcement. After discussion the report was accepted as information. A comprehensive revision of the series of specifications for railway buildings and building materials was submitted by the committee on Buildings, together with new specifications for concrete and for asphalt-asbestos felt roofing. All this material was adopted, practically without discussion. Here developed another case of conflict, in regard to separate specifications for concrete submitted by the committees on Buildings and on Masonry, and after some discussion it was voted to refer the matter of jurisdiction to the Board of Direction.

College Training for Railway Engineers—That railways do not realize how much they might benefit by the wider employment of college graduates, following the example of many other important industries, was the tenor of the report of the committee on Co-operative Relations with Universities. While there is need for trained men, college faculties have no clear idea of the kind of training required, and railway officials do not furnish them with this necessary information. Mr. Jenkins (B. & O. R.R.) remarked that some railways employ college men in subordinate positions and then forget them, thus failing to utilize these men to advantage and also discouraging them. Professor Ketchum (University of Illinois) thought that the trained men are often given jobs too small for their ability. Various industries have found that college men develop more rapidly, overcome difficulties more readily and are fit for administrative positions at an earlier age than men who have not had such training. Professor Connor (Tufts College) suggested co-operation with the Society for the Promotion of Engineering Education.

Bridges and Trestles—Specifications for waterproofing and draining solid-floor railway bridges were submitted as information by the committee on Iron and Steel Structures, which also reported progress on tests of riveted work, reamed work, bearing pressures on large rollers and satisfactory progress with specifications for highway bridges by the joint committee, including representatives of the American Association of State Highway Officials and the American Institute of Steel Construction. Information has been collected as to the use of copper-bearing steel for various purposes, but further investigation is needed as to its suitability for bridge construction. On motion of W. C. Barrett (Lehigh Valley R.R.) the rules for maintenance inspection of steel bridges, submitted by the committee on Iron and Steel Structures, were referred back to it with instructions to collaborate with the committee on Rules and Organization. This was a case of duplication of work, since the latter committee had already revised the inspection rules as now given in the "Manual."

A revised report on grading rules and classification of timber for railway uses was resubmitted by the committee on Wooden Bridges and Trestles as a substitute for matter now in the "Manual," the report of 1925 having been referred back to the committee. In a progress report on the value of treated timber, the committee concludes that such timber should be used except for temporary structures. In creosoted timber, properly treated, the strength will not be reduced materially, so that the same working stresses may be used as for untreated timber. The fire hazard is somewhat reduced, and is practically eliminated in ballasted-deck structures. As to the strength of creosoted timber it was noted by A. F. Robinson (Santa Fé Ry.) that in tests on treated and untreated stringers of Southern pine, the former showed a slight loss in strength when tested soon after treatment but regained full strength after about a year of seasoning.

This committee repeated its recommendation for printing the "Manual" in loose-leaf form, so that new matter can be added and obsolete matter removed.

The committee on Roadway submitted a revised report on the economics of filling bridge openings, which subject had been referred back to the committee at the last two meetings. Its calculations were elaborated somewhat, but the committee pointed out that cost estimates are seldom sufficiently exact to warrant nicety in calculations. In fact, "good engineering is largely the application of good judgment to a problem after consideration is given to all the data available." A progress report on a study of culverts of corrugated iron, cast iron and concrete described apparatus used in pressure tests which are still in progress. In proposed revision of the "Manual" there was a little discussion

as to the classification of excavated material, but this part of the report was finally accepted.

Miscellaneous—In bringing up to date its record of automatic train control, the committee on Signals and Interlocking pointed out the great changes made in the various systems which necessarily accompany the development of new apparatus. Most of the devices now in use are radically different from their original designs, although the principle may remain the same.

Definitions proved a stumbling block for the committee on Water Service, so many corrections and amendments being noted in its proposed revision of the "Manual" that this matter was referred back for further consideration.

Duplication of work by different committees came up again when the committee on Rules and Organization, in continuance of its preparation of comprehensive rules for the maintenance-of-way department, submitted rules in regard to water service repair men, buildings, handling explosives, care of work equipment, accidents and first-aid. Most of these were accepted, but those relating to buildings were referred back to the committee after several objections had been made on the ground of their being specifications as to methods of work. In this respect they conflict with specifications already prepared by the committee on Buildings, and Mr. Cushing (Pennsylvania R.R.) referred to frequent repetitions in the rules prepared by the committee on Rules and Organization.

A brief progress report by the new committee on Clearances pointed out that during the past decade changes have been made in dimensions of equipment, sizes and weights of shipments and in legislative requirements for clearances. Special problems are presented also by the self-propelled motor-car units now in use. The committee's work includes clearances for electrical zones, for equipment, for lading, and for safety of trainmen. Agreements for water supply, joint use of freight stations, purchase of electrical energy and joint use of pole lines were submitted by the committee on Uniform General Contract Forms, but the first two were referred back for revision.

Zoning Control of Water Supplies to Provide for Future

Changing Conditions and Increasing Opposition in Water Gathering Areas Must Be Met in Massachusetts and Elsewhere

THE TIME has come for state zoning of potential sources of public water supply, declared Allen Hazen before the New England Water Works Association on March 9, in a paper on the recent Gaw-Booth-Lockridge Water Investigating Commission report on an additional water supply for the Boston Metropolitan District and the city of Worcester. Preceding this declaration Mr. Hazen, engineer to the commission just named, outlined the plan now before the Massachusetts Legislature to take the North Ware, the Assabett and the Ipswich Rivers for an additional supply and by filtration to restore to use portions of the existing Sudbury supply (see *Engineering News-Record*, Dec. 10, 1925, p. 944). In the course of his remarks Mr. Hazen expressed surprise at the opposition to the current plan that has been voiced at the legislative hearings. The portion of the paper containing Mr. Hazen's remarks on zoning and closely related matters follows:

I am coming now to another phase of the whole water supply problem of the future that interests me very deeply. That is how far these potential sources are now available and will remain available for use when wanted. What steps can be taken now and in the near future to guarantee that these potential sources are permanently retained and held available for use until wanted? This question is not peculiar to Massachusetts. It is coming up as a tremendously important matter in many states.

In 1895 when Mr. Stearns made his report rural land values had been declining for years and were very low. The great modern development of power by hydro-electric plants had not begun, or at least had not gone far enough so that its future importance was realized. If it had been then desired I have no doubt that the necessary property and rights for the control of every one of the sources of supply now under consideration could have been secured on terms that today would look extremely advantageous. It would have been a wonderful thing for the Commonwealth if those sources could have been secured and reserved; but who could have foreseen in 1895 the development that has since taken place? There is first the automobile and the building of state roads through all the back country, increasing its availability for agricultural operations and for summer and permanent residence. There is the development of manufacturing with the addition of electricity and all the improvements that have been made in generating and transmitting power. The interest in these back lands and in the water power and process water that is capable of being produced by them is enormously greater than it was thirty years ago.

The hearings by the Committee of the Legislature in the last weeks have made it apparent that there is the strongest kind of opposition to development of any of the proposed sources; and this notwithstanding the fact that every possible effort has been made in the plans to protect local interests and reduce to an absolute minimum unavoidable injury to private property and to industries. And if this opposition is so great in 1926, what will it be in another generation for the takings that may then be necessary?

With filtration it is possible to produce good water successfully from areas carrying considerable populations; but there is a limit to this and in any case population upon catchment areas used for public water supply is undesirable and should be kept at a minimum. In the present works of the Metropolitan District it would have been fortunate if much more land for protective purposes had been secured. In the works now proposed it is not our thought that it will be necessary to remove present population well above the flow-line where the people are disposed to stay and live under reasonable rules and regulations to protect the quality of the water. But it certainly is desirable that on all present and proposed areas some steps be taken to prevent the establishment of new centers of population and of new industries such as are to be found in numerous instances upon existing catchment areas.

What we need for the state is something corresponding to the zoning of cities. That is to say, setting aside areas for future water supply and preventing industrial and suburban developments upon them, not with the idea of reducing future population and industry in the Commonwealth but of requiring it to go to areas which are not restricted in this respect. There is plenty of land in the Commonwealth for all the development in sight, and this is equally true if all land needed for future water supply is taken for such development.

At present the only certain legal method of securing this result is by the immediate purchase of such lands and rights as are necessary for the reasonable control of areas for future development. In the present report it is recommended that these areas for future development be purchased to an extent that will permit the water business to be again doubled. Whether doubling the water business again will provide for a growth of a thirty-year period as in the past, or for a forty-year period, or for a much longer period, with slower growth, is something that we cannot determine; but with reference to present conditions and present tendencies, it seems that such control of potential resources to this extent is the least that this generation can do to safeguard the interests of those that are to come.

Studies of Curing Concrete in a Semi-Arid Climate

Use of Substitutes for Water Curing Justified Where No Water Can Be Had—Seven Days' Water Curing Sufficient

By C. L. McKesson
Materials and Research Engineer,
California Highway Commission, Sacramento, Calif.

RAINFALL was considerably below normal in California during the seasons of 1923 and 1924. In some sections this resulted in a water shortage which rendered it difficult to secure water for the curing of concrete in pavement, and the State Highway Commission was confronted with the alternative of discontinuing paving operations for an indefinite period or of temporarily modifying its specified requirement of fourteen days of wet curing.

Reports of satisfactory results with calcium chloride curing in other states led R. M. Morton, state highway engineer, and C. S. Pope, construction engineer, to authorize the use, in such emergencies, of flake calcium chloride applied at the rate of 2½ lb. per square yard. Due, however, to the fact that previous experimentation with calcium chloride had been conducted in regions where average humidity is much higher than in the inland valleys of California, it was decided to conduct a study for the purpose of determining the minimum permissible amount of wet curing and the value of substitutes. Accordingly, a co-operative research was carried on in Sacramento in 1924 by the California Highway Commission and the Structural Materials Research Laboratory of Chicago. The results of this study have appeared in Bulletin 15 recently issued by Lewis Institute, Chicago.

During the season of 1924, several miles of pavement on state highways were cured with calcium chloride in Los Angeles, Ventura and Sacramento counties. For the purpose of checking up on the relative efficiency of this method of curing, cores were drilled from the pavement on calcium-chloride-cured sections and on adoining sections cured with water in the usual manner. A number of field specimens were also cured by banking with earth and by covering the surface with flake calcium chloride. The results of these tests on cores and specimens at ages of 90 days to one year appear in Table I. They indicate that calcium chloride was 80 to 90 per cent efficient at 90 days, but that at one year, there was little or no difference in concrete cured with calcium chloride and with water.

It has been shown by H. F. Gonnerman ("Effect of Age and Condition of Storage on Compressive Strength of Concrete," *Proceedings* American Concrete Institute, 1918) and others that hydration which has been stopped by lack of moisture will resume when necessary moisture is supplied. This is a very important consideration in all curing studies. In most localities, water from rainfall will become available from time to time after the completion of the pavement and will bring up the strength of concrete which has received rather scanty watering during the curing period. It is very necessary, however, that concrete should develop sufficient strength in the curing stages to remain intact until rainfall does provide necessary moisture for continued curing and added strength.

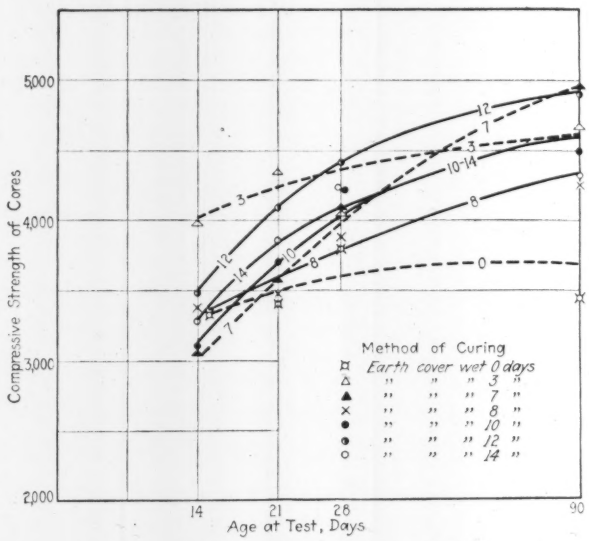


FIG. 1—COMPARATIVE STRENGTHS OF CORES FROM PAVEMENT WATER CURED DIFFERENT PERIODS

There was no rainfall throughout the season in which the concrete was being cured with calcium chloride. Temperatures were rather high and relative humidity was low (15 to 40 per cent in daytime).

The strengths obtained by the use of this substitute for water are fairly good and seem to justify its use when no water can be had, but there is appreciable evidence of scaling on the sections so cured. This scaling is shallow, probably ⅛ in. or less, but it is quite general over the surface of the pavement.

It was thought that the laboratory and field tests of 1924 should be verified by additional tests. A field series was therefore started in the early summer of 1925. Results up to 90 days are now available and they substantiate the results of previous investigations.

TABLE I—AVERAGE COMPRESSIVE STRENGTH OF WATER AND CALCIUM CHLORIDE CURED CONCRETE

Location of Experiment	No. of Samples	6x6x12-In. Molded Specimens Cured With Water, 28 Days Lb.	6x6x12-In. Molded Specimens Cured With Calcium Chloride, 28 Days Lb.	4½-In. Cores from Pavement Cured With Water, Lb.	4½-In. Cores from Pavement Cured With Calcium Chloride, Lb.	Efficiency of Calcium Chloride, Per Cent†	Remarks
(X—Sac.-4-B) Sacramento-Stockton highway, near Sacramento	24	.....	.....	*4,292	*4,218	98	*Hot and dry (water-cured concrete 57 days old. Concrete cured with calcium chloride 70 days old).
	20	.....	.....	**5,064	**5,042	99	**Cores drilled and tested at 1 year age.
(VII—L.A.-2-BC) Ventura-Los Angeles highway near Calabasas	32	3,064	2,783	.....	.....	91	Hot and dry.
	28	.....	.....	4,057	3,294	81	
(VII—Ventura-2-A) Los Angeles highway near Newbury Park	12	.....	.....	3,491	3,093	88	Hot and dry.
(I—Hum.-1-GH) Eureka-Arcata highway at Arcata	72	3,887	3,545	.....	.....	92	Experiment in October. Weather cool, humidity high (70 to 90 per cent). Some rain.

† Efficiency of calcium chloride curing, assuming water curing to have been 100 per cent efficient.

TABLE II—CALIFORNIA HIGHWAY COMMISSION CURING TESTS

Compressive Strengths of 6 x 12-In. Moulded Cylinders and 4½ x 7-In. Drilled Cores, (1925 Series) Concrete Mix 1 : 1.9 : 3.8 using 6 sacks of cement per cubic yard.

	Watering Period	*28 Days 6x12-In. Cyl.	Age of Test: 14 Days **Cores Lb./Sq.In.	14 Days ***Strength Ratio	21 Days **Cores Lb./Sq.In.	21 Days ***Strength Ratio	28 Days **Cores Lb./Sq.In.	28 Days ***Strength Ratio	90 Days **Cores Lb./Sq.In.	90 Days ***Strength Ratio
Section 1	14	3,296	3,285	100	3,873	118	4,229	128	4,301	132
Section 2	12	3,105	3,468	112	4,103	132	4,414	142	4,895	157
Section 3	10	2,930	3,123	107	3,694	126	4,225	144	4,475	153
Section 4	8	2,968	3,366	113	3,483	117	3,877	130	4,264	144
Section 5	7	3,118	3,073	99	3,596	115	4,101	132	4,924	158
Section 6	3	3,356	3,948	118	4,323	129	4,068	121	4,659	139
Section 7	0	3,378	3,329	99	3,436	102	3,814	113	3,465	103
Average	..	3,164	3,370	106	3,787	119	4,104	130	4,426	141

NOTES:
* 6x12-in. Cylinders made in accordance A.S.T.M. Standards, and cured in water for 28 days. Each strength an average of 10 specimens except Sec. 7 in which only 4 specimens were made.
** Cores drilled with Calyx Shot Drill. Cores tested were free from visible defects. Each strength is an average of 5 cores.
*** Strength Ratios are ratios of core strengths to 28 day strengths of cylinders from same section.

A pavement widening project near Sacramento was chosen for the most recent experiment in curing. A 6-ft. width of 7-in. pavement was being built on each side of the old 15-ft. pavement. Concrete approximately 1:2:4 (six sacks of cement per cubic yard) was mixed in a central mixing plant and hauled to the work in side-dump trucks. Successive sections of pavement, each constituting a day's run of 500 to 1,000 ft., were cured by covering with earth and by watering for 3, 7, 8, 10, 12 and 14 days. One short section was covered with dry earth and received no water.

It was expected that there would be a slight variation in the strength of concrete from day to day. In order to secure a standard for comparison of relative efficiency of different watering periods, ten 6x12-in. concrete cylinders were molded each day and sent to the laboratory for 28-day curing in water at 70 deg. F. These cylinders were taken in pairs at intervals of 50 to 200 ft. and the exact spot from which they were taken was marked on the pavement. Cores were drilled later at the places from which the concrete for the cylinders had been taken. In studying the efficiency of various methods of curing, the compressive strengths of the cores can be compared with 28-day laboratory-cured specimens from the same batches of concrete. Cores were drilled from each section and tested at 14, 21, 28 and 90 days. Cores having rock pockets or other noticeable defects were discarded and drilling continued until five good cores were obtained from each section. In all, 140 cores and 64 cylinders, 6x12 in., were tested.

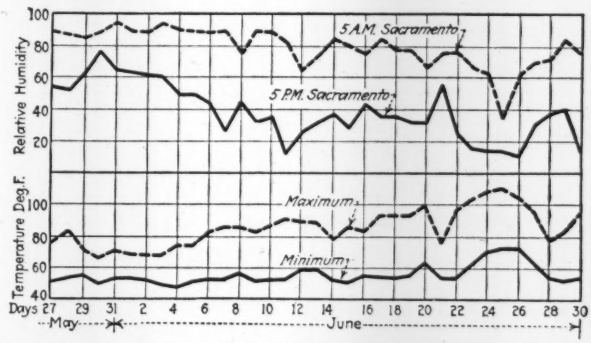


FIG. 2—TEMPERATURE AND HUMIDITY CURVES

Table II shows the results of the tests of 28-day laboratory-cured 6x12-in. cylinders and of cores taken from identical batches of concrete after curing by watering for periods of 0 to 14 days. Five cores and ten laboratory-cured specimens are included in each value given, except as otherwise noted. The cores in each lot gave reasonably uniform results. The results of these tests are also shown in Fig. 1.

The specimens which received a dry earth covering without watering made a good strength showing in 14-day tests. At 90 days, there was no appreciable gain in strength of concrete cured without watering, showing clearly that, while mixing water, reduced by evaporation losses, was nearly sufficient for hydration through the first 14-day period, no moisture remained for additional hydration during the remainder of the 90-day curing period.

The cores drilled from this unwatered section showed the surface of the concrete to be much softer than on other sections. A number of these cores had tops rounded off by drilling operations and it was necessary to drill several extra cores on this account. The surface hardness was satisfactory on all of the water-cured specimens regardless of length of watering period.

Three-day watering gave very satisfactory results at all ages. These results seem to indicate that the first three days is the critical period in the curing of the concrete and that, if sufficient water is supplied during this period, it will remain in some chemical combination, to carry on hydration for at least 90 days.

That such excellent results may be secured with this small amount of watering may throw some light on the reason for the satisfactory results had in other states with calcium chloride, even when washed off in a few hours.

Maximum strength at 90 days, according to this test series, was secured by keeping the concrete watered for 7 days. There was no appreciable gain in strength by additional watering up to 14 days.

During the time these tests were under way the normal temperature was high, humidity very low and there was no rainfall. Fig. 2 shows temperature and humidity during the 28 days following the placing of the concrete. These unfavorable curing conditions rendered the test a very severe one.

The results so closely corroborate previous investigations that the following conclusions seem entirely justified:

1. The watering period for concrete pavement may safely be reduced to seven days.

2. A further reduction in time of watering to three days is permissible in emergencies.

3. The tests were made on concrete in pavement and the results should not be applied to concrete in thin exposed reinforced slabs. The results could probably be applied to mass concrete or to concrete in walls which are protected on one or more sides by earth backfill.

Traveler Erects Heavy Trusses for Theater Roof

Trusses Weighing Up to 150 Tons Lifted 130 Ft. and Set on Columns 120 Ft. High by Traveler Carrying Two 75-Ton Derricks

A STEEL traveler of remarkable size is erecting the columns and trusses for the auditorium of the Paramount Theater Building in New York. With its derricks and other essential loads the traveler weighs nearly 500 tons. Its main framework is 52x72 ft. and 84 ft. high, as big as the frame of many an old seven-story city building. On top are two derricks with 50-ft. masts and 75-ft. booms. It has to lift assembled trusses and columns, the largest being main roof trusses 122 ft. long and 16 ft. high, weighing 150 tons, from the pit level of —15 where they are assembled to +115 where they span the auditorium. Dimensions and task together make the traveler perhaps the greatest ever employed in building construction. Incidentally the Paramount Theater is one of the largest and the office building which screens the theater on its Broadway side, is one of the highest in America.

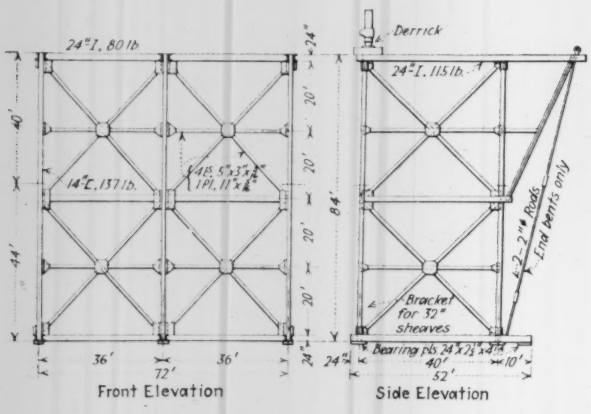


FIG. 1—ELEVATIONS OF FRAMING OF TRAVELER

Time requirements made the theater and the loft portions of the building virtually separate erection problems. The theater had to be completed fully three months ahead of the office building. Also the latter was conventional loft erection while the theater erection involved some rather special problems. A diagram plan of the theater showing the place of the traveler is given in Fig. 3. A row of columns on each side defines the auditorium and the proscenium arch. The main columns are 20 in. square and 105 ft. high above the first floor splice, giving a total length of about 130 ft. They carry clear span trusses. Ultimately there will be a gallery floor hung from the trusses but for erection operations the space below trusses and between columns is open. The theater erection task was then to put up the 105-ft. columns weighing up to 55 tons and place on them the roof

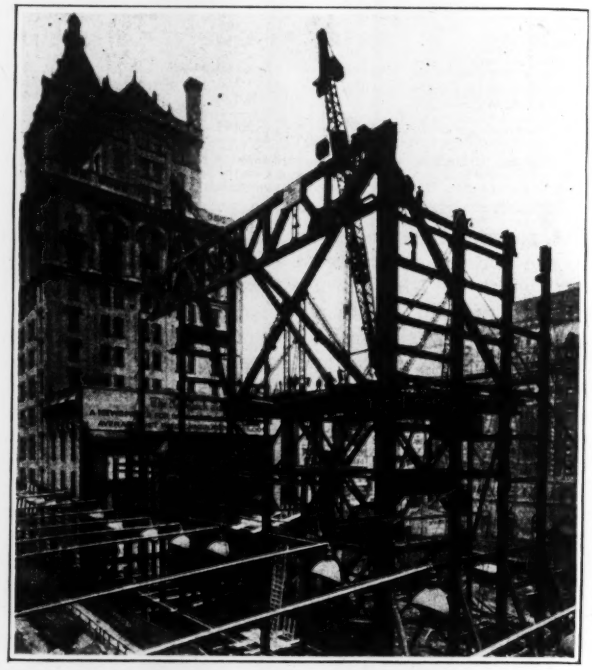


FIG. 2—TRAVELER HOISTING FIRST ROOF TRUSS

trusses weighing up to 150 tons and having the clear spans shown on Fig. 3.

A study of alternative erection methods disclosed that erection by traveler of assembled columns and trusses appeared fully as cheap as stage erection with falsework. Again speed of erection by traveler promised to be much faster. Assembling on the ground of trusses—there were 30 pieces and 4,000 field rivets for each—could be much quicker and safer than on false-

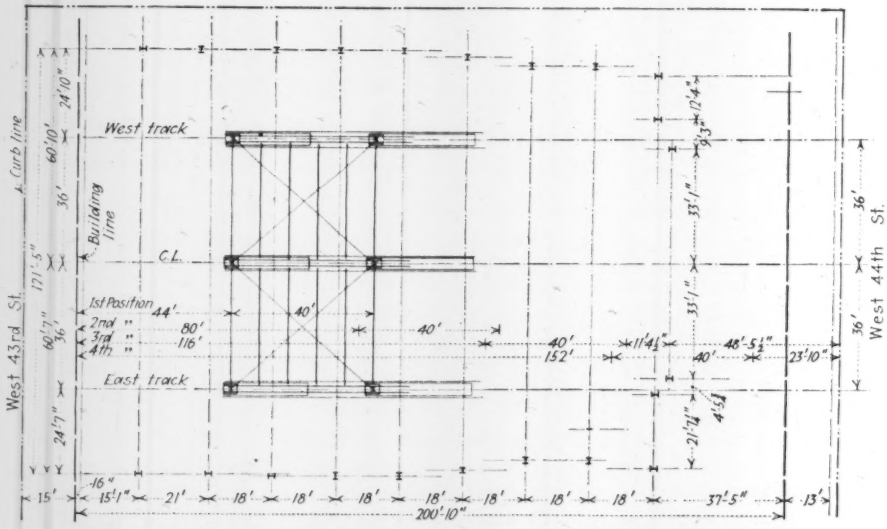


FIG. 3—DIAGRAM OF TRAVELER SHIFTS IN ERECTING ROOF TRUSSES

work 130 ft. high. Once assembled, erection of full trusses and columns, with the traveler, was about as rapid as hoisting any separate part. When erection is

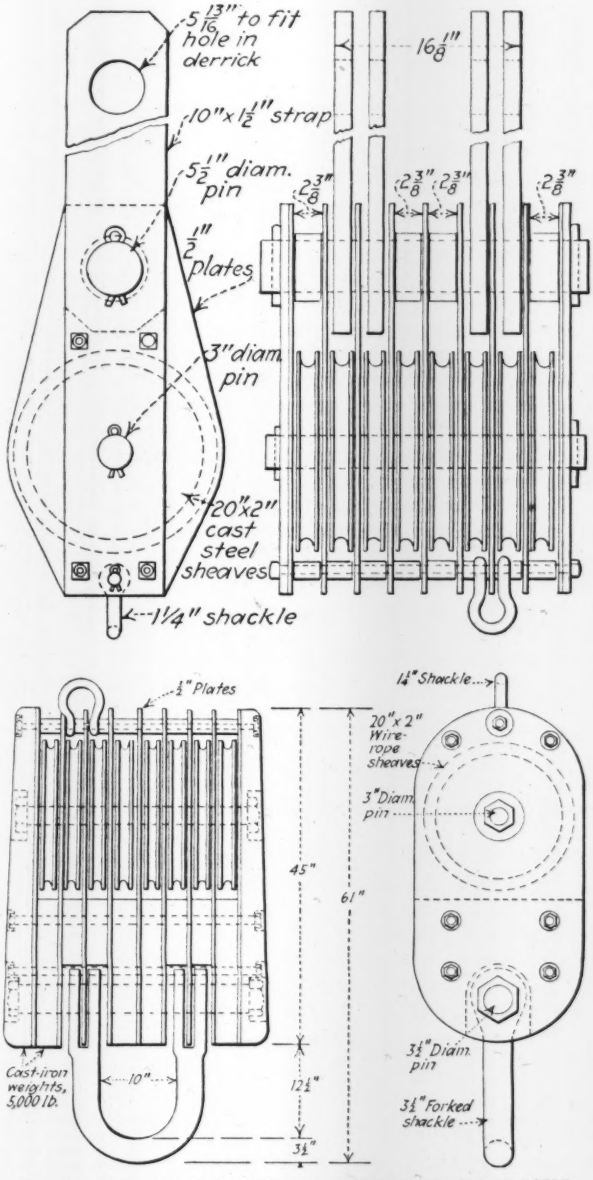


FIG. 4—DETAILS OF SPECIAL EIGHT SHEAVE BLOCKS

completed there is substantially full salvage of the traveler and equipment.

The traveler structure and dimensions are shown by Fig. 1. It is carried on rollers on three lines of rails. The rails are 80 lb., and there are 13 in the three lines, five on each side and three in the middle, set close side by side on timber trackways built up from the pit bottom. The rollers are 2½-in. steel. The traveler is moved by block and tackle; Fig. 3 indicates the distances of the successive shifts and the total travel. Its equipment is the significant feature of the traveler, however, and not its structure. The derricks are 75 ton all-steel, stiff-leg machines. Each has an extra heavy, cast-steel, double drum Lambert hoist operated by a 75-hp. Westinghouse motor designed for nearly 100 per cent overload. Observe that the equipment named is specially made and designed. This is true also of the blocks which were designed by Frank Baldwin & Son, New York, and built by the Boston & Lockport Block Co. They are among the largest blocks ever built as shown by the dimensions of Fig. 4. A 17-part line of ¾-in. rope is used with these blocks. Fig. 5 indicates the tackle and lashing; eight turns are taken around the top chord through the shackle and a steadying turn down and around the bottom chord.

In erection the first operation was to set up the four pairs of columns shown in Fig. 2. Until the trusses were up, as will be seen, there was little steelwork to brace these columns. They were therefore strongly held by inclined shoring, struts to the traveler frame and guy lines in all four directions. Fig. 2 shows something of this maze of bracing. It was prepared with the utmost care. For example the guy anchors were 1½-in. cables cemented into 12-ft. holes drilled in the rock and each anchor was tested with a 50-ton jack. Indeed the hoisting and placing of the trusses were comparatively simple operations. Each truss was lifted and set in about 1½ hours, a large part of which was consumed in booming out or in and swinging to get clearance. The straightforward hoisting speed was about 10 ft. a minute. The views show the erection of the first truss. For

FIG. 5—DETAIL SHOWING TACKLE AND LASHING FOR LIFTING TRUSS

the second truss the traveler was moved back and so also for succeeding trusses; the successive movements are indicated on Fig. 3.

The traveler was designed by George Simpson, chief engineer, Thompson-Starrett Co., the general contractors for the building, and was fabricated by the American Bridge Co. H. C. Kranichfeld is general superintendent for the contractors, and Owen Eachus is superintendent of steel erection.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

German Text on Civil Engineering

REVIEWED BY I. GUTMANN
Civil Engineer, New York City

LEHRBUCH DES TIEFBAUES—Herausgegeben von Esselborn. 6 bis 8 Auflage. Zweiter Band: Brückenbau, Wasserversorgung und Entwässerung der Städte, Kanal- und Flussbau, Landwirtschaftlicher Wasserbau. Bearbeitet von A. Braubach, H. Engels, P. Gerhardt, W. Teubert, Ph. Volker. Leipzig: Wilhelm Engelmann. Paper or cloth; 8x11 in.; pp. 894; over 1,300 line cuts and halftones. Cloth, 19, bound, 22.5 marks, gold in Germany.

"Tiefbau" which is the subject of this well-known textbook is a rather strange German term. Literally it means "deep construction," which naturally makes one think of tunnels, shafts, caissons, deep foundations in general and similar matters. And true, "Tiefbau" treats of these types of engineering construction, but surprisingly enough, it also treats of railroad track, bridges, dikes, filters, water towers and many other classes of structures which the non-German does not readily associate with the concept of depth. In fact, "Tiefbau" is practically coextensive with our term "Civil Engineering," while its antonym "Hochbau" (High Construction) corresponds to our "Architectural Engineering."

This text, which is only one of a series of engineering texts edited by Prof. Karl Esselborn of Darmstadt, is a collective work originated by a group of professors of the Technical College of Darmstadt in 1904. Since then the original staff of authors has changed more than once, the book has doubled in size and its scope has been enlarged; one of its volumes has seen six editions, the other eight; and it has gradually become a standard, seasoned text enjoying a solid reputation on the continent of Europe.

The first volume (not reviewed here) consists of seven "chapters"—books we would call them—dealing with the following subjects: Surveying, Excavation and Earthwork; Retaining walls, Dams and Seawalls; Foundations, Streets and Highways, Railroad Engineering, Tunnels. The second volume, now before us, contains the following books: Bridge Engineering, by Dr. Ph. Völker; Municipal Water Supply and Sewerage Engineering, by Adolph Braubach; Rivers and Canals, by Dr. Wilhelm Teubert; Marine Engineering, by Dr. Hubert Engels (reprinted from the third edition of his Handbuch des Wasserbaues); Agricultural Hydraulics, by Paul Gerhardt.

The text apparently presupposes a familiarity with the theoretical foundations of engineering and proceeds to describe types of engineering structures and methods of construction, briefly reviewing in each case the underlying theoretical principles. The discussion impresses one as logical, systematic and lucid. Though elementary in spots, yet it contains more details than one would generally expect to find in a two-volume text covering practically the whole field of Civil Engineering. To assist the reader in making further, more detailed studies, numerous references to other texts and to technical periodicals have been indicated in the footnotes

It is a German text, decidedly German by the selection and proportioning of its material, by its illustrative examples and by its bibliography. Types and methods which are more common or more likely in German practice are discussed more or less fully, while others which are not, or are not yet common in Germany, though quite popular elsewhere, may not even be mentioned. Thus there is a rather full discussion of movable dams and not a word about multiple arch dams. The "chapter" on bridges, (over 100,000 words) has not one word about suspension bridges. Practically all the illustrative examples are from German or Austrian practice. The bibliography is entirely German. This is possibly all justifiable from a pedagogic point of view, still it is a pity that so few engineering texts, English as well as German, are as cosmopolitan as they should be in order to be true to the very spirit of engineering.

This textbook is naturally at its best when treating of subjects in which German engineers excel most, notably water purification, sewers and sewage treatment, river regulation, irrigation of non-arid lands. The discussions and illustrative examples pertaining to these subjects might be read with interest and profit in America. There are many details which are original and suggestive, as: The architectural treatment of water towers, the adaptation of the hydraulic ram to large capacity pumping by means of low heads, movable systems of overhead irrigation, etc. This last item would be of timely interest to engineers in California where overhead irrigation is rapidly gaining in favor.

A text of so wide a scope, giving a comprehensive perspective of the whole realm of Civil Engineering, in a readable literary form, is bound to counteract overspecialization and consequent narrowing of vision and lessening of interest which menace the modern student of engineering. Is it not to be regretted that unified textbooks of this type have become practically obsolete in our own technical literature?

Great Lakes-St. Lawrence Ship Channel

TRANSPORTATION ECONOMICS OF GREAT LAKES-ST. LAWRENCE SHIP CHANNEL—By Alfred H. Ritter, Transportation and Port Specialist. Washington, D. C.: Great Lakes-St. Lawrence Tidewater Association. Paper; 6 x 9 in., pp. 276; illustrated. $1.50.

The author in this book supplements an earlier work by himself and Dr. R. S. MacElwee entitled "The Economic Aspects of the Great Lakes-St. Lawrence Ship Channel." The present work does little more than emphasize the statements of the earlier one that the St. Lawrence navigation development would be fundamentally an economic boon and that by its opening the great area of the United States extending as far east as Utica, as far south as Memphis and as far west as Salt Lake City would become tributary to the St. Lawrence area.

Mr. Ritter is at present connected with the War Department in the investigation of the various ports of the United States. He emphasizes, however, in the preface to this book that the views he states here are in no sense the expression of the views of that department.

Chadwick and Public Health in England

SIR EDWIN CHADWICK (1800-1890)—By Maurice Marston. Boston: Small, Maynard & Co.; London: Leonard Parsons. Cloth; 5x8 in.; pp. 186; front portrait.

THE MINISTRY OF HEALTH—By Sir Arthur Newsholme, K.C.B., M.D., F.R.C.P., Principal Medical Officer Local Government Board, England and Wales, 1908-1919, merged in the Ministry of Health. London and New York: G. P. Putnams Sons, Ltd. Cloth; 5x8 in.; pp. 271. $2 (5s. net in London).

By a happy coincidence these two books appear together. One deals with a man who nearly a century ago began research and reform work which led to the establishment of a short-lived British Board of Health, which with himself was legislated out of office the middle of the last century, while the other book is concerned with the new Ministry of Health which was not created until 1918.

Edwin Chadwick, pioneer in English poor, factory, sanitary and health research and administration, born in 1800 and living to the ripe old age of 90 years, was retired from public office at 54 after a quarter century of notable service for his country because he was some decades ahead of his time and lacked tact. He knew no way but the ideal (to him the only right way). He had the opposition and hatred of land and factory owners and the church on the one hand and on the other the poor whom he wished to serve. He antagonized both the local and central governments and was scathingly criticized and soundly abused by the press. Many of the poor, factory, sanitary and health reforms Chadwick formulated and helped start were finally carried out in greater or less degree, but the National Board of Health was abolished in 1855, although some of its functions were performed by other departments meanwhile, and especially by the Local Government Board from the 70's until the creation of the Ministry of Health in 1918. But there is this to be said for England that could not be said for some other countries: When in the prime of life Chadwick was legislated out of office he was given a pension of £1,000, a goodly sum in those days.

The little book on Chadwick, in the admirable Rodmaker series, first sketches the poor law and its background for two or three centuries, then takes up Chadwick's investigations of the poor law, factory, sanitary and public health administration. Finally it summarizes more briefly his many activities as a private citizen in the same general field for the three and a half decades more following his forced retirement from public office.

The somewhat larger but still small volume—for so large a subject—on the Ministry of Health opens with a brief survey of poor law, health and related matters before Chadwick's time and on until the major and basic Public Health Act of 1875. Then both local and central health administration in England are brought down almost to the present day, with their many intertwining activities, such as poor relief, health and unemployment insurance, medical school administration, and state medical service.

The stress on "filth and disease" which is carried through both these volumes is striking. This would be expected of the book on Chadwick, whose official career ended seventy years ago, and might be expected of the early historical portion of the book on the Ministry of Health. At the close of the book on Chadwick there is an incidental hint of changed conceptions of health-protective work which might well have been reflected here and there throughout the book without dimming the picture of Chadwick. Turning to the other volume, it is a bit surprising that Dr. Newsholme should assert on his third page that one of the three primary functions of government is "protection against the dirt and filth of human aggregation, which threaten the health of every man, woman and child," without saying a thing there and little elsewhere of the more modern conception of the spread of infectious diseases. As regards both books, it should be remembered that public health work and poor relief reform in England grew up together, as the volume on Chadwick shows, and have gone on hand in hand ever since—and, judging from Dr. Newsholme's book, bid fair to continue to do so for years to come.

New Issue of Kershaw's Sewage Disposal

SEWAGE PURIFICATION AND DISPOSAL—By G. Bertram Kershaw, M. Inst. C. E., Consulting Engineer, Late Engineer to the Royal Commission on Sewage Disposal, M. Am. Soc. C. E., Fellow Royal Sanitary Institute, Fellow and Past President Inst. Sanitary Engrs. Second Edition. [Cambridge Public Health Series.] Cambridge (England): University Press; Agents in the United States: The Macmillan Co., New York City. Cloth; 6x9 in.; pp. 361; 59 line cuts and charts. $6.80.

Except for a new chapter on the activated-sludge process, this book is little changed from the first printing, which was favorably noticed in *Engineering News*, June 17, 1915, p. 1175. The new chapter contains 24 pp. of which 18 are devoted to activated sludge—which, naturally enough, was not gone into in the first edition. The new chapter has 3 pp. on sludge digestion, two on straw filters and a short bibliography on activated sludge. The latter contains two or three American references, but neither these nor the text convey any idea of the status of the activated-sludge process in the United States and Canada. For a British book the first edition was notable for its references to American practice. These are now sadly out of date. Great Britain fares little better as far as recent data or references are concerned, outside the added chapter. A thorough-going revision would have been welcome. If British sewage treatment has stood still for a dozen years, except as regards the activated-sludge process (which we doubt) there is all the more reason to show changes in other parts of the world.

People and Resources of North America

NORTH AMERICA: Its People and the Resources, Development and Prospects of the Continent as an Agricultural, Industrial, and Commercial Area—By J. Russell Smith, Professor of Economic Geography, Columbia University, Author of "Industrial and Commercial Geography," "Commerce and Industry," "Human Geography." New York: Harcourt, Brace & Co. Cloth; 6x9 in.; pp. 849; 410 line cuts and halftones. $6.

To describe within the pages of a single book the "People and the Resources, Development and Prospects of" all North America "as an Agricultural, Industrial and Commercial Area," is an undertaking that might well daunt the most ambitious of authors. Yet, Professor Smith has succeeded to an appreciable measure in his task. Each of the chapters deals with one of the natural divisions of the continent, setting forth a description of its physical features, its agricultural, mineral and industrial development, together with a brief summary of its prospects as the author sees them. As might be expected, the major difficulty in carrying out this plan has been to effect an appropriate balance in the treatment of his many-sided subject. In view of this it is to be regretted that any of the precious space should have been wasted in doggerel verse, newspaper cartoons, quotations from Sunday magazine supple-

ments and other inconsequential matter that adds neither to the substance nor to the readability of the book. The maps and diagrams are well selected and skillfully handled and are so comprehensive in their scope as to give them a genuine reference value.

Lake Tana Irrigation Storage Project

REPORT OF THE MISSION TO LAKE TANA, 1920-21 [with notes on later observations]—By G. W. Grabham, M.A., F.R.S.E., F.G.S., Government Geologist, Anglo-Egyptian Sudan, and R. P. Black, M.C., M.A., B.Sc., Inspector, Physical Department, Ministry of Public Works, Egypt. Cairo, Egypt: Ministry of Public Works. Boards, cloth back; 8½x13 in.; pp. 207; many plates of diagrams and halftones, some folding. Price not given.

Aside from the interest attaching to this report as the third preliminary study of a great storage prospect for the benefit of Egypt and the Anglo-Egyptian Sudan, it is a document of appeal to any engineer who likes to take an occasional glance beyond his own specialties. It deals with an expedition into a country strange to most of us—Abyssinia—during which many difficulties due to inaccessibility, climate, food and other physical conditions were met and cordial relations had to be maintained with the central government of the country penetrated, its regional chiefs, major and petty, and humble natives who saw in the red flags and other engineering paraphernalia various menaces to their welfare.

The mission of 1920-21, combined with some later observations included in the report, confirm earlier conclusions as to the possibility of storing and releasing vast quantities of water in Lake Tana, on the Blue Nile. Comparatively simple and inexpensive regulating works, it is concluded, "after allowing for evaporation losses, would permit the control of about 6,200 million cubic meters of water in the reservoir," of which 3,500 millions "may be stored annually" under average conditions and 2,700 millions could be used "to make up the deficiencies in low seasons."

The report describes in detail the slow progress of the expedition on its way to the lake, due to poor transportation facilities, rains and delays incident to getting necessary government permits and dealing with natives en route. The gagings and surveys are set forth with numerous data on matters affecting the consummation of the storage project, among which climate, transportation, labor and materials, personal and camp equipment, and even a long list of things suitable as presents for big and little chieftains—by no means the least interesting portion of a report full of matters of both human and technical interest.

Depreciation in Theory and Practice

DEPRECIATION IN PUBLIC UTILITIES: Relation of Accrued Depreciation to Annual Depreciation and Maintenance—By Delos F. Wilcox. [National Municipal League Monograph Series.] New York: National Municipal League. Boards; 6 x 9 in.; pp. 112. $2.

Clearly and pungently Mr. Wilcox explains depreciation both as he thinks it should be and as it appears to him to have worked out in ten cases which he reviews. He scores such utility companies and their experts as contend that there is no depreciation in a well maintained plant when a rate basis is being established but insist upon it as an essential item of revenue to be allowed in the rates themselves. Nor does he hesitate to score court referees and the courts themselves for some of their opinions and rulings.

The monograph is in three parts: (1) Confusion in Depreciation Theories; (2) A Method of Arriving at Accrued Depreciation; (3) Illustrations of Street Railway Practice in Depreciation—at Chicago, Cleveland, Montreal, Grand Rapids, Milwaukee, New York, Boston, San Francisco and Detroit. In the first section ten "causes of confusion" as regards depreciation are set up and examined. These are: Difficulties in measuring deterioration and in forecasting obsolescence; improper correlation of the whole plant with its units; varying standards of maintenance and different meanings of "condition"; failure to tie together accrued and annual depreciation; varying policies as to reserves; disturbing effects of "market value" and of "fair value" concepts; and "temptations to corruption of the expert mind."

The cities chosen for study in the second part represent ways of handling depreciation under "settlement" contracts, state regulation, municipal ownership after purchase or building, municipal ownership and private operation and private ownership with state operation. The final Conclusions begin with: "The depreciation theories and practices exemplified in the street railway systems of the ten cities included in this description and analysis are representative of the confusion and absence of uniformity characteristic of this branch of public utility administration." They end thus: "It is also important that municipally owned utilities should not be controlled by depreciation theories developed by private companies for the purposes of propaganda in connection with valuation and rate cases."

The National Municipal League has rendered a service in presenting Dr. Wilcox's views and reviews on a highly controversial subject. Will it now seek out as capable, as honest and as hard a hitter to present the case for the private utilities?

PUBLICATIONS RECEIVED

A SPANISH-ENGLISH EDITION of the Am.Soc.T.M. Standard Specifications for Structural Steel for Buildings may be had for 5c. from the Superintendent of Documents, Washington, D. C.

THE FIRST OF THIRTEEN technical bulletins issued by the Southern Pine Association (New Orleans, La.), to be had free of charge by those sufficiently concerned, deals with flooring. It contains a "specification and design information and data for the use of architects and engineers."

AN INDUSTRIAL SURVEY AND REPORT on the Raritan District by Charles W. Staniford, consulting engineer, has been made to the Port Raritan Survey Commission. It contains a study of existing and proposed channel, docking, and other transportation facilities in relation to the industrial development of this district.

THE TECHNICAL ADVISORY CORPORATION, New York, after a study of the railroad problem in Dayton, Ohio, has issued a pamphlet, "Grade Crossing Elimination—The Improvement of Railroad Conditions in Dayton, Ohio." In addition to the proposed elimination of grade crossings, the report outlines a plan for the general improvement of local railroad conditions.

ZINC DUST PAINT TESTS, in which some 2,000 gal. of paint were applied to steel, wood, canvas and other surfaces, including the interior of a large industrial water tank, are reported in a Research Bulletin entitled Metallic Zinc Powder as a Paint Pigment, published by the New Jersey Zinc Co., 160 Front St., New York City. Among the conclusions reached was that "as a rust inhibitive metal

primer" this material "is at least equal to any other high grade commercial primer" and that "it also makes a grey finish paint with a very high binding power that completely covers any surface in one coat." Suggestions for the use of the material are given.

THE FAUNA OF IMHOFF TANKS, by J. B. Lackey, continues the Studies on the Biology of Sewage Disposal conducted jointly by the New Jersey Agricultural Experiment Station and the New Jersey State Department of Health. The studies relate chiefly to the Imhoff tanks forming part of the Sewage-works of Plainfield, North Plainfield, and Dunellen, N. J., which, the pamphlet states, "have only a protozoan fauna." Observations at the sewage disposal plant at Chatham and Westfield, N. J., and of water from the polluted portion of the Passaic River show protozoa about the same as those at Plainfield. (For copies address New Jersey Agricultural Experiment Station, New Brunswick, N. J.).

INFORMATION ABOUT MARIEMONT, the new residential village near Cincinnati, Ohio, constructed by The Mariemont Co. (328 Walnut St., Cincinnati, Ohio), the capital stock of which is all owned by Mrs. Mary M. Emery, "projector and sponsor," is given in a well-illustrated 64-p. pamphlet. The village was planned by John Nolen, Philip W. Foster, associate, town planners, Cambridge, Mass. It has water and sewer service through connections with the systems owned by Cincinnati, and various other central services, including heating. Fay, Spofford & Thorndike, Boston, designed the water, sewer, storm drain and heating systems, with French & Hubbard, Boston, as consulting engineers on the latter. The laying out of the plan for Mariemont was described in *Engineering News-Record*, April 3, 1924, p. 586.

THE HISTORY AND PROBLEMS of the Philadelphia gas works, with special reference to the renewal of the lease of the works then pending, make up an interesting 149-p. pamphlet published recently by The Philadelphia Bureau of Municipal Research (311 S. Juniper St., Philadelphia, Pa.). The study was made chiefly by Charles A. Howland, engineer of the bureau's staff. The works have been in existence some ninety years. They were leased by the city to the United States Gas & Improvement Co. in 1897. The study summarizes results to the city and company under the lease and critically examines the new indeterminate lease pending when the report was published but executed since then.

QUICK WORK in the publication of the *Proceedings* of the American Society for Municipal Improvements might well be emulated by other associations and is a welcome change for this one. Last year's convention was held Oct. 26 to 30. The *Proceedings* were received for notice here on March 2. They run to 647 pp. and are grouped under Street Paving and Design, Street Maintenance, etc., City Planning, Public Welfare, Street Lighting, Sewerage, Sanitation and Garbage Disposal, Water-Works and Various other heads, including reports of committees on various specifications. ($7.50, cloth bound, from C. W. S. Sammelman, secretary, 315 Commercial Building, St. Louis, Mo.)

A MASTER'S THESIS of more than ordinary interest and usefulness because written with a background of experience is The City Manager Plan in California, by R. M. Dorton, now city manager of Monterey, Calif., who has had a half dozen years' experience as city manager there and elsewhere. California was a good state to take for such a thesis, because 33 of its cities have managers. The author briefly reviews municipal government in California, the manager plan in general, and the experience of California cities under the plan. The thesis ran through several issues of the *City Manager Magazine* last year and may be obtained by sending 50c. to John G. Stutz, executive secretary, City Managers' Association, Lawrence, Kan.

A DEPARTURE in stream flow records is claimed in the Introduction to Discharge Records of North Carolina Streams, 1889-1923 (Bull. 34, North Carolina Department of Conservation and Development, Raleigh, N. C.). To quote: "It is the first publication of the kind to present tables of weekly stream flow and to give duration curves of weekly stream flow for all long-term records." The bulletin extends to 405 pp. and includes curves as just stated, together with a large folding map showing the location of the various stations and also a folding diagram of discharges by streams. It was prepared by the Water Resources Division of the department named, of which Prof. Thorndike Saville, Chapel Hill, N. C., is chief hydraulic engineer, in co-operation with the U. S. Geological Survey, N. C. Grover, chief hydraulic engineer, with E. D. Burchard, district engineer for North Carolina.

THE PUBLIC PAYROLL—federal, state and local—of the United States, excluding soldiers, sailors and those making less than half time, is estimated at from 2,500,000 to 3,000,000 persons in a Preliminary Report of the Conference Committee on the Merit System, which bears the general title, The Personnel Problem in the Public Service. The conference named is in effect a joint committee of persons appointed by but not officially representing five civic and research organizations, of which two are devoted specifically to the civil service. Representing the National Municipal League are Henry M. Waite and H. W. Dodds. Mr. Waite was formerly city engineer of Cincinnati, then the first city manager of Dayton, Ohio. The report deals with the magnitude of the personnel problem in the public service and the functions of personnel departments; it outlines six plans of department organization, and states the advantages and disadvantages claimed for each; presents statistical and other data bearing on the general subject in question, and presents a draft of an act to create a state or a city employment commission. The main part of the detailed work of collecting and presenting the data and opinion composing the report was done by the Bureau of Personnel Administration and the report is published as Vol. IV, No. 1 (January, 1926) of Public Personnel Studies (35c. from Bureau Public Personnel Administration, 26 Jackson Place, Washington, D. C.).

New Books and Revised Editions

[*Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.*]

BETRIEBSWISSENSCHAFT: Überblick über das lebendige Schaffen des Bauingenieurs—Von Dr.-Ing. Max Mayer, Duisburg. Berlin: Julius Springer. Boards; 7x10 in.; pp. 219; 31 halftones and line cuts. Boards, 16.5 reichsmark in Germany.

POPULAR RESEARCH NARRATIVES, VOLUME II: Fifty brief stories of research, invention, or discovery, directly from the "men who did it," pithily told in language for laymen, young and old—Collected by the Engineering Foundation. Baltimore, Md.: The Williams & Wilkins Co. Cloth; 5x8 in.; pp. 174; portrait of Michael I. Pupin. $1.

Fifty more short readable stories which summarize research or progress, each in some field of interest or importance. An index of subjects and narratives is provided. The earlier volume is still available, bound in cloth, for 50c., or both volumes for $1.50.

UP-TO-DATE AIR BRAKE CATECHISM: Treating on the Various Old and New Brake Equipments Manufactured by the Westinghouse Air Brake Co., Containing 2,250 Questions with Their Answers—By Robert H. Blackall; Revised, Enlarged and Rearranged by F. H. Parke, General Engineer with the Westinghouse Air Brake Co. Thirtieth Edition. New York: The Norman W. Henley Publishing Co. Cloth; 5x8 in.; pp. 707; 270 line cuts and halftones. $4.

Covers various old and new brake equipment, including those for steam and high-speed electric passenger trains, gasoline rail cars, motor vehicles, etc. Two of the earlier editions were noted in these columns March 18, 1907, and Aug. 17, 1911.

USE OF WATER IN IRRIGATION—By Samuel Fortier, D.Sc., M.Am.Soc.C.E., Hon. M. Am. Soc. Agricultural Engrs., Associate Chief, Division of Agricultural Engineering, U. S. Bureau of Public Roads, Consulting Professor of Irrigation Investigations and Practice, University of California. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x8 in.; pp. 420; many halftones, drawings and charts. $3.

WASSERMESSUNGEN BEI WASSERKRAFTANLAGEN—Von Dr.-Ing. L. A. Ott, Kempten (Allgau), Germany. [Sonderdruck aus Wasserkraft-Jahrbuch 1924.] München: Richard Pflaum. Paper; 6x9 in.; pp. 30; 15 halftones and line cuts.

In part an extension of the discussion in the chapter on Discharge Measurement in the British Standard Test Code for Hydraulic Power Plants, published for the World Power Conference, 1924.

WATER PURIFICATION PLANTS AND THEIR OPERATION—By Milton F. Stein, B.S., C.E., M.Am.Soc.C.E., Sanitary Engineer. Third Edition, Revised and Enlarged. New York: John Wiley & Sons Co.; London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 316; 105 halftones and line cuts. $3; 15s. net.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Study of Engineering Education

Sir—I have been very much interested in the article of W. E. Wickenden on "Progress of the Study of Engineering Education," published in *Engineering News-Record*, Jan. 14, 1926, p. 73. I should like to have a little more information concerning the collection of data recorded in Table I, showing percentage of graduates remaining in engineering and in Table II, giving percentage of activities of recent and of older graduates, and the charts showing earnings of engineering graduates and teachers.

The statement submitted that the chart of earnings is especially compiled from the returns from 6,000 of the graduates of 40 institutions and 2,000 teachers of 75 institutions, and that it is obtained from the three most recent classes of graduates and in 5-year intervals preceding. It is simply a matter of mathematics to ascertain that the returns are simply an average of 150 graduates per institution, which when spread over the three recent classes and six other classes back for a 30-year period, makes an average of somewhat less than 20 per class.

It seems possible that this is a relatively small number of returns and for very obvious reasons would largely consist of graduates who have been among those most successful financially. The average man of a class of 20 or 25 years ago is not apt to admit on a printed page, even under the strictest promises of secrecy, that his income is $2,000 or less. I hasten to remark here that my own salary is well within the median reported so it is not a personal matter, yet it is a matter of personal knowledge that many graduates of many years standing, in fact a large majority of graduates in any institution employing a large number of engineers, have incomes less than the average reported.

An engineering educator told me within the last year that only about 40 per cent of the graduates responded to such questionnaires for reasons best known to themselves. I believe it would be of interest if Mr. Wickenden would tell what percentage of replies were actually received out of a total number of engineering graduates in the classes canvassed. If 50 per cent or less replies were received, is it not reasonable to assume that they were the more successful men and those who have actually remained in engineering work? Is it not also reasonable to assume that the information in Tables I and II was obtained in the same way and that the percentage of men leaving the profession, who reported, are among those who have been more successful than usual in other work, and that a much larger percentage of those who did not report actually dropped into other fields but did not care to admit it? Also is it not even more reasonable to assume that those men in classes of 1909 or before who are not in administrative positions would be very largely among those who did not report?

If these assumptions have any foundation isn't the information given, especially in the chart of earnings, somewhat misleading to prospective engineers, both in school at the present time and more especially to those who are contemplating entering school to get an engineering education?

All this is not without its pertinence as is indicated in the editorial of *Engineering News-Record* of Dec. 31, in which the statement is made that it is more important that the $1,500 to $3,000 engineers get 25 per cent increase than that the $12,000 engineering executive be raised to $20,000.

Wichita, Kan., Jan. 22, 1926. P. L. BROCKWAY, City Engineer.

[Mr. Wickenden sends the following explanation.—Editor.]

Sir—Referring to the letter of P. L. Brockway concerning the data on earnings of graduates and teachers, we have made every effort to obtain as trustworthy information as can be had through the appeal of the colleges to their graduates. The percentage of replies received to questionnaires sent out to the several classes ranges from fifty as a maximum to thirty as a minimum. In the case of the older classes, a considerable number of questionnaires were returned because of incorrect address. It would appear that the percentage of replies returned to graduates actually reached is in the range from fifty-five to forty.

The degree to which these returns may be taken as representative can not be accurately determined. The distribution of those received follows a normal curve nnd there is no preponderance of exceptionally large or small incomes. The figures obtained from colleges which reported a large percentage of returns do not differ significantly from those reporting a small percentage of returns. The group of colleges included is quite representative both geographically and as to types of institutions. The results have been expressed in terms of medians and percentile groups rather than averages, in order to minimize the effect of exceptionally high incomes. Furthermore, we believe the median to be more nearly characteristic of the average man than the average salary.

As a further test of the reliability of the information, a comparison was made between the first half of the returns received with the first three-quarters and finally with the entire number without significant differences. After a careful examination of the facts, I do not believe there has been a marked tendency on the part of the less successful to refrain from reporting.

As the information concerning the tendencies of engineering graduates to remain in engineering and to evolve from technical to administrative positions was drawn from the same sources as the information on earnings, the two types of information are of the same degree of trustworthiness.

The information concerning the incomes of engineering teachers is believed to be highly trustworthy as it was submitted anonymously by 80 per cent of all who were asked for this information.

WM. E. WICKENDEN,
Director of Investigation, Society for the Promotion of Engineering Education.

New York City,
Feb. 2, 1926.

Effect of Tire Chains on Pavement

Sir—E. F. Kelley of the United States Bureau of Public Roads, has given an interesting article on "Wearing Surfaces for Concrete Bridge Floor Slabs" (*Engineering News-Record*, Jan. 7, p. 26). In this article Mr. Kelley refers to the tests made by the Bureau on the experimental road at Arlington, Va., as reported in *Public Roads*, Vol. 5, No. 3, May. 1924. One element in the Arlington test vitiates part of the results for comparison with actual traffic conditions. The non-skid chains used in the second part of this test were placed on the front or idle wheel of the experimental truck instead of on the rear or driving wheel of the truck. The test, as made, accomplished its object—to compare different concretes to resist abrasion, but the result is a comparison only. Had the chains been placed on the rear, or driving wheels of the experimental truck, the results of the test would be comparable with actual traffic conditions.

Portland, Ore., Feb. 24, 1926. ERNEST S. ROSS.

Sir—Mr. Ross states that in the wear tests conducted at Arlington the chains were placed on the front wheel of the experimental truck. This is true, and it is also true, as he states, that this fact must be considered in attempting to make any comparison between the tests and actual traffic conditions. However, in my article I made no such comparison and cited the tests simply to show that concrete pavements will wear appreciably when subjected to the abrasive action of non-skid chains. I emphasized this point since some engineers maintain that modern traffic does not produce wear in concrete pavements and, therefore, that surface protection is not essential.

From the standpoint of my article, it is not important that the test conditions did not coincide exactly with actual traffic conditions. The point is that chains will produce wear in concrete pavements and whether more or less than was produced under the test conditions is immaterial. As a matter of fact, it is my opinion that had the driving wheels of the experimental trucks been equipped with chains instead of the front wheels the wear would probably have proceeded at a faster rate.

E. F. KELLEY,
Acting Chief, Division of Tests, Bureau of Public Roads.

Washington, D. C., March 8, 1926.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

State Engineers Asked for Political Contributions

Illinois Highway Department Heads Suggest Payment to Governor's Defense Fund

Engineers of the highway department of Illinois have been appealed to by various heads of the department to contribute to a fund now being raised for the defense of the governor of the state, Len Small, in his fight before the courts in the matter of the restitution of approximately a million dollars interest which it is claimed was lost to the state during his term as state treasurer. The latest move in that fight is the recent ruling of the Supreme Court of Illinois that the governor is liable for an amount to be determined by the Sangamon County Court. The whole matter has become a vital political issue in the state with threats of impeachment to follow. To assist the governor there has been organized by his friends and supporters what is known as the "Len Small Defense Fund," to which general contributions are being sought.

At a meeting of the state highway engineers at Urbana the last week in February, a special appeal was made by State Highway Engineer F. T. Sheets to the engineers to contribute to this fund. Newspaper reports state that specific demands for sums in proportion to salaries were made. At the request of *Engineering News-Record* Mr. Sheets has sent the following telegram regarding that meeting:

"At request of director of department who was ill I called men together at conclusion of recent highway meeting and explained move of governor's friends to raise defense fund. Explained governor's stand in permitting Illinois gigantic road program to proceed along scientific modern engineering principles with efficiency, square dealing and sound business methods as invariable policy. Explained his support of my efforts to advance scale of engineers' salaries in department. Explained what his friends in other branches of state government were doing and stated hopes that response of our men would be generous. Stated however, matter purely voluntary and for each man to decide. Policy of voluntary contribution stands in spite of efforts of partisan press to make appear otherwise. People of Illinois do not agree with certain newspapers as evidenced by governor's return to office for second term by large majority. Same papers have consistently misrepresented our highway work for past five years and opposed recent state bond issue adopted by people by three to one favorable majority. This should explain their sudden interest in the engineers' welfare."

The following letter has also been sent to the engineers in District No. 1 by G. N. Lamb, head of that district:

"To the members of the engineering staff of district No. 1:

"I am requested to bring to your attention an appeal from the officials of our department for contributions in an amount approximating one-half of one month's salary to apply toward the Len Small defense fund. This contribution should be by check, payable to C. R. Miller, treasurer, and forwarded to Ralph R. Benedict, assistant chief highway engineer, division of highways, Springfield.

"In case you have made a previous contribution for which you desire credit please mention this fact at the time of forwarding your checks.

"We have had every demonstration and proof of the integrity, of the sound engineering principles, and of the high minded policies of our superiors—Frank T. Sheets, C. R. Miller, and our governor, Len Small.

"I can assure you that they have fully and conscientiously considered our personal and collective interests in making this appeal and that they believe their decision to be for the good of the people of our state. We are now facing a crisis which causes us to make a choice between personal interests and perhaps a more or less extended personal sacrifice for the vindication of the right policies.

"I am appealing to you not to be influenced by the action that may have been taken by others, but to decide this question in your own minds entirely on its merits and as your conscience directs."

G. N. LAMB,
District Engineer.

There is much resentment on the part of a number of the engineers at these efforts and protest meetings have been held in several of the districts. The Chicago metropolitan chapter of the American Association of Engineers has adopted resolutions protesting against the reported solicitation of money from the state engineers as "despicable, contemptible and degrading . . . and in contravention of every right legally guaranteed to the individual." The governor is asked in the resolution to furnish an admission or disavowal of the charges made.

Engineering Fifty Years Ago

From *Engineering News*, March, 1876

A PETITION has been presented to the City Council of Boston, signed by firms representing $100,000,000 of property, also by a large number of physicians, praying for immediate action to give the city a defined system of parks, sewers, and drainage, on the ground of its necessity and the cheapness of land and labor. The scheme which has been presented proposes an expenditure of something like six or eight millions for a complete sewerage and park system.

Florida Keys Trying to Solve Fresh Water Supply Problem

For the purpose of obtaining a supply of fresh water for Key West and the other Keys of Monroe County, Fla., the Monroe County Water Supply District has been created with C. D. Stearns, captain, U. S. Navy, retired, chairman of the board of trustees. Information is desired as to the best way of getting fresh water, either by district construction of a pipe line from the mainland or through a franchise grant.

E. E. Wall Dismissal Still in Abeyance

Mayor of St. Louis Changes Charges Against Public Service Director But Takes No Final Action

Staff Correspondence

It is time the engineers of the country knew of the St. Louis politicians' raid on the engineers in its staff of city employees. The following is based on interviews with engineers and business men in St. Louis on both sides of one of the gravest situations an engineer executive has to meet in holding a political office; choice between (1) firing a competent assistant, (2) getting out himself or (3) being discharged, the latter meaning the same to his assistant as (1). Such is the situation between E. E. Wall, director of public utilities, 33½ years a trusted employee of St. Louis and past director of national societies, and Victor J. Miller, 37-year-old lawyer mayor, elected on a non-partisan ticket largely through the efforts of the women and their organizations.

DISAGREEMENTS OVER CONTRACTS

The disagreements apparently started over the award of contracts first in the water department, which is one division under Mr. Wall, and later over letting a lighting contract to an outside contractor. Disgruntled unsuccessful contractors obtained hearings through the mayor and then failed to appear except anonymously through a lawyer and the board of public service of which Mr. Wall is one of five refused to listen. In this the mayor backed them up at the time (January) but now brings up anew as "still sticking in his craw."

Then in quick succession come the requests that Ralf Toensfeldt, electrical engineer, be let out and George Heath, a discharged foreman, substituted. There were preliminaries in the way of requests for investigations of Toensfeldt's past activities in inventing a new type of street lamp, and objections to the terms of a set of specifications on a recently advertised street lighting system. This latter contract was let to the low bidder, but the award was unsatisfactory to the mayor, who first demanded that Mr. Wall remove Mr. Toensfeldt and upon Mr. Wall's refusal the mayor demanded his resignation.

Mr. Wall took the position that he could not resign under such charges without ruining his own reputation and destroying the morale of the whole city staff. The mayor thereupon filed charges of vague and indefinite nature involving inefficiency, neglect of duty and misconduct in office. Of the nine points charged, when it came to a hearing March 10, one was dismissed and four revised and amplified. Mr. Wall's attorneys asked for time to prepare a defense of the new material. The mayor, who is prosecuter, witness and

judge in the case, granted a continuance until March 15. The charter states that the mayor may remove his appointees "for cause," but as in most city charters the clause is so indefinite that the most trivial excuse only is necessary.

St. Louis is holding Mr. Wall by public opinion, even the newspapers hitherto favorable to the mayor backing Mr. Wall. Each new edition has an editorial condemning or ridiculing the mayor. The Associated Engineering Societies through their joint council of fifteen support Mr. Wall "in his refusal to discharge competent employees," refute the allegation of incompetency on Mr. Wall's part because he is not "equipped with a practical knowledge of applied electricity," point out Mr. Wall's outstanding ability as a water-works engineer which is the big end of his work and state that to lose him in the midst of progress on the new water plant would be nothing short of a calamity. The Chamber of Commerce has attempted mediation without success.

SUBORDINATE ENGINEERS UNEASY

With St. Louis about to spend ten to fifteen million dollars annually contractors as well as material and equipment concerns who desire a square deal are about to lose one of their best friends. Subordinate engineers in St. Louis city employ are already on the lookout for work elsewhere for they feel that civil service is no protection when their discharge is contingent on the mayor without charges from their immediate superior.

Individuals close to the mayor contend that there has been lack of cooperation on Mr. Wall's part with the other four members of the board of public service, that he has not been willing to "talk over" vital matters with the mayor and otherwise show respect due the office. Slanderous remarks are alleged. In consequence they cannot see any other course for the mayor than dismissal.

The hearing scheduled for March 15 is still in progress at this writing. So far there have been no important developments.

New Jersey Appropriates Money to Build Fort Lee Bridge

An appropriation of $5,000,000 in five annual installments, for the construction of the Hudson River bridge from Fort Lee, N. J., to 178th St., New York City, was voted by the New Jersey legislature last week and approved by Governor Moore. The appropriation is contingent on a similar appropriation by the Legislature of New York State. The joint amount of $10,000,000 is intended to give the enterprise a sufficient financial basis to permit of the sale of bonds for the remainder of the cost, which will probably reach or exceed $50,000,000. Construction of the bridge is to be carried out by the Port Authority, which is to issue its bonds against the toll income of the bridge just as was done a few weeks ago for the two Arthur Kill bridges connecting Staten Island and New Jersey.

Prof. A. N. Talbot First Marburg Lecturer

The American Society for Testing Materials has announced the selection of Arthur N. Talbot, professor in charge of theoretical and applied mechanics, University of Illinois, as the first Edgar Marburg lecturer. This lecture has been established by the society to be delivered annually by leaders in the development of promotion of knowledge of engineering materials. It is named in honor of the late Edgar Marburg, professor of civil engineering, University of Pennsylvania, who was for so many years secretary of the American Society for Testing Materials. Professor Talbot's work in testing materials is too well known to require description. He is a past president of both the American Society for Testing Materials and the American Society of Civil Engineers and an honorary member of both societies.

Committee Meets on Organization of Public Works

The committee composed of members of the engineering organizations of the country who were appointed at the instance of the American Engineering Council to further its plan to develop the most practical organization of the public works functions of the government met March 13 and 14 at the American Society of Mechanical Engineers headquarters, New York City. The committee has received no instructions from the American Engineering Council and is therefore free to develop the organization of any new department according to its own ideas.

At this first meeting of the committee, E. O. Griffenhagen, senior partner of the firm of Griffenhagen & Associates, Ltd., management engineers of Chicago, was selected chairman. Mr. Griffenhagen reorganized the Canadian government departments in 1919 and was in charge of the Congressional commission on reclassification in 1920. He was selected to serve on this committee by the Society of Industrial Engineers. A. C. Oliphant, assistant secretary, American Engineering Council, was selected to serve as secretary of the committee. Other members of the committee and the organizations which appointed them were as follows: Dr. Elwood Mead, director of reclamation, by the Department of the Interior; Sanford E. Thompson, consulting management engineer of Boston, by the Taylor Society; Col. John Price Jackson, of the New York Edison Co., past dean of the School of Engineering at Pennsylvania State College, by the American Society of Mechanical Engineers; Wallace Clark, consulting industrial engineer, New York City, by the Taylor Society; J. L. Jacobs, by the Society of Industrial Engineers; W. F. Willoughby, director of the Institute of Government Research, by the American Engineering Council.

Meetings will be held by the whole committee and subcommitteees as required and it is contemplated to have the complete report available for the use of Congress by early fall.

Gale Wrecks Factory; Prosecutor Finds No One Responsible

A report on the failure of a factory building in New Britain, Conn., on Feb. 4 has just been made by the city prosecuter. He finds that there was no negligence on the part of anyone and that "the excessive high wind at the time was an important factor in the failure."

The structure concerned was a one-story building 225 ft. long by 70 to 94 ft. wide and about 20 ft. high, consisting of 12-in. brick walls carrying steel roof trusses with partly wooden and partly concrete and gypsum-block roof. The trusses rested on 4-in. pilasters of the wall, making the total thickness here 16 in. About noon on Feb. 4, during a heavy blizzard with the wind at gale velocity from the northwest, the building fell sidewise into the street, toward the southeast. Eight men were killed.

An investigating committee of local officials and engineers found that the roof steelwork was free from all signs of failure, and that no evidence of any explosion could be discovered.

The building was in several sections built at different times, the older having been built 23 or 24 years ago. Part of the roof originally contained skylights, but about a year ago these were taken out and gypsum block covering substituted. These changes in the roof covering, however, are found not to have endangered either the trusses or the walls by direct load, although it was concluded that the weight of the concrete roof covering was excessive for the size of supporting pilaster as originally built. The conclusion was reached that "one or more of the brick pilasters failed, and the roof structure dropped at that point, bringing the entire structure down." This view is accepted by the city prosecuter. He concludes:

"The causes of this disaster cannot be ascribed to the criminal negligence of any one or more persons. Many elements of nature entered into the accident such as heavy snowfall, the strong wind, driving the snow upon the roof, the age of the walls and weakening of the cement in the pilasters of this wall and the wall itself."

Seattle Rejects Manager Plan and Elects Woman Mayor

In a hotly contested election that brought out over 95,000 voters, Seattle, Wash., rejected a city manager charter amendment by only 103 negative votes, declared for a charter revision commission by 4,702 majority, and chose Mrs. Bertha K. Landis as mayor by a majority of about 6,000 over Dr. Edwin J. Brown, the present mayor. Mrs. Landis favored the manager amendment, although its adoption would have automatically barred her from becoming mayor, while Mr. Brown stood for charter revision. Mrs. Landis is now president of the Seattle City Council. She is a graduate of Indiana University, and wife of Henry Landis, dean of geology at the University of Washington.

Water Bureau Men Dismissed by Mayor of Philadelphia

The chief engineers of two of the water-works pumping stations of Philadelphia were summarily dismissed by the mayor on March 13 charged with neglect in the maintenance of equipment and inefficiency in operation of their stations. The dismissed employees are George McGowan, chief engineer of the Shawmont station on the Schuylkill and Robert Kerr, chief engineer of the Torresdale station on the Delaware. Both men have been in the city service for many years and will have a chance to defend themselves before the Civil Service Commission. Temporary appointments have been made of Walter Diamond, an operating engineer in the Water Bureau, to take charge of the Shawmont station and of Samuel H. Thompson, superintendent of pumping stations, to take charge of the Torresdale station.

Water Supply Failed

Complete failure of the water supply in the section of the city served by the Shawmont station occurred Feb. 26 to 28, after several weeks of reduced pressure. In the agitation following the failure, some members of the city council as well as business associations in the affected area demanded the dismissal of Alexander Murdoch, chief of the water bureau. Chief Murdoch held that the troubles were due principally to the necessity of using soft coal during the coal strike and also to inefficiency and conspiracy of subordinates in the bureau who were seeking to secure his dismissal. Mayor Kendrick appointed John W. Ledoux, consulting engineer, Philadelphia, to investigate conditions at all the city pumping stations, and to report upon the troubles. In his report, Mr. Ledoux stated of the Shawmont Station: "It is dirty and has every appearance of repairs neglected and upkeep ignored. This stricture holds for the entire station and its equipment. In appearance it is more like the plant at a rolling mill or a tannery."

Mr. Ledoux specified many instances of neglect of upkeep and maintenance at the Shawmont pumping station, and a rundown condition of boilers, neglect and general slovenliness at the Torresdale pumping station. The other three pumping stations were found by Mr. Ledoux to be in good condition while at two of them there were evidences of efficiency and resourcefulness of operation.

As to the claims made that the failure of the Shawmont station was due to the enforced use of soft coal, Mr. Ledoux urged (1) that there was plenty of time to have got and stored hard coal in advance of the coal strike; (2) that soft coal better suited to the plant could and should have been obtained; and that the grates should have been adopted to the use of soft coal. Why the Shawmont station should ever been permitted to get into so bad a state as Mr. Ledoux stated was a subject for speculation; he suggested that the proposed abandonment of the station may have had something to do with the lack of interest in its upkeep.

Railway Engineers Hold Big Annual Meeting

Attendance Exceeds 1,000—Program Handled on Schedule But with Little Discussion

(Engineering News-Record Staff Report)

A more rapid rate of increase in membership of the American Railway Engineering Association is desirable and logical, for although the membership is large numerically, it is small in proportion to the great number of railway engineers and officials. This was the theme of the presidential address of J. M. R. Fairbairn, chief engineer of the Canadian Pacific Ry., at the annual meeting in Chicago on March 9 to 11. His address, therefore, gave a review of the activities and opportunities of the association, and an explanation of the value of the work it is accomplishing. The annual increase in membership has ranged from 1 to 16 per cent, with an average of 3½ per cent. The report of the secretary showed a total membership of 2,304, of whom 1,574 are in the engineering department. This is a net increase of 77 members, while 21 members were lost by death. The receipts for 1925 were $50,927, with expenditures of $49,744. The attendance at the meeting again broke the record, reaching a total of 1,030, with 831 members and 199 visitors. This compares with 988 for 1925 and 987 and 833 for 1924 and 1923 respectively.

The reports of 25 committees, all printed in advance and including about a hundred reports of subcommittees, were comprised in six bulletins, totaling about 1,150 pages. All this material was disposed of formally according to schedule, though at the expense of discussions which should have added to the value of the material and to the interest of the meeting.

C. P. Ry. President Speaks

At the annual dinner, the principal speaker was E. W. Beatty, president of the Canadian Pacific Ry. In referring to the work accomplished by engineers in the railway field he called attention to the exchange of railway men between the United States and Canada, how two of the presidents of the Canadian Pacific had been born in this country and one great American railroad builder had been a Canadian. This reciprocity in men and the reciprocity of ideas, as exemplified in the A.R.E.A., he said, was the best proof of the abiding friendship which exists between the two countries. Mr. Beatty said that the railroads needed and welcomed men with university training but that these men should realize that they must not expect to start at the top or half way up the ladder; that at the start they had no advantage over the man of only practical training; that they must start at the bottom and depend on their better training to advance them more rapidly than other men. All that was needed he said was a willingness to work hard and put their best effort into their work. An address on unity of the nations was given by Rev. A. P. Shatford, of Montreal, while the more technical subject of wood utilization by the railroads was covered in an address by D. F. Holtman, of the U. S. Department of Commerce.

Two presentations took place at the closing session; a medallion being given to H. R. Safford, past president, on his retirement from the board of direction, and a silver cup to J. M. R. Fairbairn, the retiring president.

Officers for the ensuing year are as follows: President, C. F. W. Felt, chief engineer of the Atchison, Topeka & Santa Fe Ry. System; second vice-president, W. D. Faucette, chief engineer of the Seaboard Air Line. Daniel J. Brumley, chief engineer of the Chicago terminal improvements, Illinois Central R.R. automatically becomes first vice-president succeeding Mr. Felt. Geo. H. Bremner, treasurer, and E. H. Fritch, secretary, were re-elected.

Inspection Trips

A feature of the convention this year, which in effect carried it through a fourth day, was a series of inspection trips arranged for Friday. One was to inspect the car retarders installed in Markham and Gibson yards, one to the plants of the Illinois Steel Co. and the Universal Portland Cement Co., one to the frog and crossing plant of the Pettibone-Mulliken Co., and a fourth trip to inspect some of the larger municipal construction projects at Chicago.

Water-Works Improvements at Quincy, Mass., Authorized

The city council of Quincy, Mass., on March 8, authorized the expenditure of $600,000 for 8- to 20-in. cement-lined cast-iron pipe, a 1-m.g. steel tank at ground level, a 0.4-m.g. steel tank on a tower and for lowering an existing 0.3-m.g. tank which rests on a tower. The latter tank was built without allowance for the hydraulic grade line, so the water does little more than cover the bottom. John J. Cosgrove is commissioner of public works and Metcalf & Eddy, Boston, are consulting engineers for the improvements.

March Meeting N.E.W.W.A. Devoted to Metropolitan Water

The luncheon meeting of the New England Water Works Association on March 9 was one of the largest ever held, there being 168 at lunch while a number more came in time to hear Allen Hazen's paper on the water problem of the Boston Metropolitan Water District and the City of Worcester. Besides outlining the report of the Water Supply Investigating Commission now before the Massachusetts' Legislature, Mr. Hazen suggested state zoning of water supplies, as reported elsewhere in this issue. Charles R. Gow, chairman of the commission, said that if the commission had realized the opposition to its plant it would have written a more militant report.

The meeting elected the following committee to nominate officers for 1926-7: George Finneran, C. W. Sherman, R. D. Chase, George Batchelder and W. F. Sullivan.

WASHINGTON NOTES

DECISIVE developments in Lakes-to-Hudson waterway project are in prospect. Proponents and opponents of the ship canal across the state of New York have been heard by the Board of Engineers for Rivers and Harbors, which has before it a strongly adverse report of the engineer commission created by special statute. The board of engineers is expected to lay its findings before the Chief of Engineers so that the latter official can report his findings to Congress not later than March 24.

Representative Dempsey, of New York, has requested that the finding be made available by that date so that that Rivers and Harbors Committee, of which he is chairman, may act on the project in time to include it in the legislative River and Harbor bill.

Those advocating the so-called all-American route contend that the commission has overestimated the cost and has underestimated the benefits. In addition, they are placing great stress on the value of such a waterway in connection with the national defense.

One of the important developments growing out of the filing of the report was the letter written by Secretary of War Davis to Representative Dempsey of New York. In that letter Secretary Davis said that "from the military standpoint it is essential that waterways connecting the Great Lakes with the Atlantic seaboard shall be entirely in American territory." He made the point that "in the event of a great war the transportation of the agricultural products and raw materials of the Middle West to the Atlantic seaboard and to the thickly populated industrial areas of the Eastern and New England States, would impose a great burden on the railroads."

Secretary Davis also draws the general conclusion that "inland waterways are of military value to supplement rail and highway transportation. War frequently makes increased demands on railroads even when these are not located in the theater of operations. Delay caused by congestion of transportation facilities may have a decisive military effect. The availability of waterways to relieve railways at the time of their peak loads is a great military asset."

WHILE the new tax law, over the protest of the Treasury Department, authorizes tax refunds to municipal and state employees engaged in business enterprises, the act leaves such employees subject to tax in the future.

Judging from the small support for the proposal to exempt this class of municipal and state employees, it seems probable that Congress will continue to require such employees to pay taxes as do the employees of private business establishments. Their only hope of exemption now rests on the possibility of securing a favorable ruling by the Supreme Court on one of the cases now in the lower courts.

C. F. W. Felt Elected Head of A.R.E.A.

Chief Engineer of Santa Fe System Succeeds Fairbairn of Canadian Pacific

The election of Charles F. W. Felt to the presidency of the American Railway Engineering Association at its annual meeting in Chicago last week, brings to the head a man who has long held a deep interest in the affairs of that organization.

Mr. Felt was born in Salem, Mass. in 1864, and educated at the Massachusetts Agricultural College. Except for two years, he has been connected with the Atchison, Topeka & Santa Fe System since 1886. At this time he started as an axman on construction, progressing to rodman and bridge engineer. From 1888 to 1890 he was connected with the Denver & Rio Grande R.R., the Arizona & Southeastern R.R. and on location surveys in Mexico. In 1890 he returned to the Santa Fe Lines as resident engineer of the Northern division of the Gulf, Colorado & Santa Fe Ry. He was then office engineer for the Rio Grande Southern Ry. from 1892-93, returning to the Gulf, Colorado & Santa Fe Ry. in February, 1893, as division engineer, becoming chief engineer in 1896. He later held the office of chief engineer of the eastern and western lines of the Atchison, Topeka & Santa Fe, and in 1913 assumed his present duties of chief engineer of the Santa Fe System. Mr. Felt has always taken a great interest in the A. E. R. A., acting from March 1921-24 as a member of the Board of Direction, being elected second vice-president in 1924 and first vice-president in 1925. Since 1922 he has been a member of the Committee on Rail, and in 1923-24 acted as chairman of the sub-committee to jointly investigate transverse fissures with the Bureau of Standards.

He has also been prominently associated with various other engineering associations.

Mr. Felt succeeds J. M. R. Fairbairn, chief engineer of the Canadian Pacific Ry., the first native Canadian to serve as president of the association.

C. F. W. Felt

Engineers Make Favorable Report on Fort Lee Bridge

Reporting on studies of the proposed New York-New Jersey bridge over the Hudson River from 178th St., New York City, to Fort Lee, N. J., the engineering staff of the Port of New York Authority in a series of preliminary findings made public late last week declares that conditions are in all respects favorable to the project. Sufficient traffic will flow to the bridge that even in the first year after completion the revenue will more than cover administrative and fixed charges, with a balance for amortization; and this without involving unreasonably high toll charges. It is also found that there are no engineering difficulties in construction. The engineers state that "the bridge is in every respect feasible, and, while of unusual magnitude, will involve no extraordinary difficulties nor hazardous or untried operations." The location of the bridge is described as well chosen with regard to the topography and to the highway connections; and the 178th St. crossing is described as the next logical step after construction of the vehicular tunnel at Canal St., now nearly complete.

Borings indicate that rock at 80 to 100 ft. depth is found at the New York pierhead line, while beyond this the depth to rock is excessive; on the New Jersey side rock at the pierhead line is beyond feasible depth for pneumatic foundations, and the recommended pier location is therefore a short distance inland from the pierhead line. Between pier head lines rock has not been reached by borings carried to 150-ft. depth. Under the circumstances a single-span design is proposed, the required span between the piers being 3,500 ft.

The design is a two-cable suspension bridge carrying a single-deck roadway, so detailed, however, that the utilized width of deck can be increased and a partial lower deck can be added to carry rapid-transit tracks or motor-bus ways, with increase of the number of cables at the same time. The tentative design drawings show eyebar chains, but no decision has been reached as to a choice between wire cables and chains.

A clear height above water of 200 ft. has been chosen, as best suiting the topography of the two shores. The towers would be about 650 ft. high above water, and would be built of concrete-incased steel faced with stone.

The cost of initial construction is set at "less than $50,000,000," while the indicated enlargement of the bridge from an initial limited deck width would involve an additional cost of $15,000,000 to $25,000,000. These figures are inclusive of interest during construction. They depend upon such forecast of real estate values as can now reasonably be made.

The state of New Jersey has appropriated $5,000,000 for the start of this work, the fund being contingent upon the appropriation of a like sum by New York, as noted on p. 462 of this issue. The remainder of the cost will be raised by Port Authority bonds.

Engineering Societies

Calendar

Annual Meetings

NATIONAL CONFERENCE ON STREET AND HIGHWAY SAFETY, Washington, D. C.; Second Annual Conference, Washington, D. C., March 23-25, 1926.

NATIONAL CONFERENCE ON CITY PLANNING, New York City; Annual Meeting, St. Petersburg, Fla., March 29-31, 1926.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, N. Y.; Spring Meeting, Kansas City, Mo., April 14-16; Summer Meeting, Seattle, Wash., June 14-16; Annual Convention, Philadelphia, Pa., October 4-9, 1926.

NATIONAL FIRE PROTECTION ASSOCIATION, Boston, Mass.; Annual Meeting, Atlantic City, N. J., May 10-13, 1926.

CONFERENCE OF STATE SANITARY ENGINEERS, Washington, D. C.; Annual Meeting, Buffalo, N. Y., June 5 and 7, 1926.

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Meeting, Buffalo, N. Y., June 7-11, 1926.

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Convention, Philadelphia, Pa., June 13-19, 1926.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, State University of Iowa, Iowa City, June 16-18, 1926.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J.; June 21-25, 1926.

INTERNATIONAL CITY MANAGER'S ASSOCIATION, Lawrence, Kansas; Annual Convention, Colorado Springs, Colo., Sept. 21-23, 1926.

The New Jersey Sewage Works Association will hold its annual meeting at Trenton, March 26; the program will include a round table discussion on "The Surcharging of Sanitary Sewers by Runoffs from Rain and Melting Snow" and "The Effect upon the Sewage Treatment Plant." Practical application of the findings of the New Jersey Sewage Experiment Station will be discussed by a subcommittee consisting of Richard Gould of James H. Fuertes' office and Weston Gavett of Clyde Potts' office.

The Associated Technical Societies of Cleveland, Ohio, at its March 23 meeting will discuss industrial water supplies, with a special paper on "The Relations Between Quality of Water and Industrial Development in the United States," by W. D. Collens; it is announced that the material for this paper is drawn principally from a report (not yet published) of a comprehensive study recently completed on the subject by the Water Division of the United States Geological Survey. As an added feature of the meeting, representatives of several chemical, paper, rubber and other industries using large quantities of water in their manufacturing processes will discuss the paper, companies represented being the Hammermill Paper Co., B. F. Goodrich Rubber Co., Firestone Tire and Rubber Co., Industrial Fibre Co., and Goodyear Tire and Rubber Co.

The National Conference on City Planning in its program for the annual meeting at St. Petersburg, Florida, March 29 to 31, includes discussions of water front works, especially Florida water fronts; laws needed in the aid of good city planning and zoning; the psychology of city planning; opportunities and dangers in periods of rapid development; the planning of resort communities; the place of the railroad in the city plan; contributions to the solution of the traffic problem; campaigning for city planning; and local planning and zoning in Florida.

Personal Notes

E. B. PARSONS, consulting municipal engineer, has opened an office at Watertown, Wisconsin.

E. M. SHAFTER has been appointed city engineer of Royal Oak, Mich., after three years' service in the city's engineering department; Mr. Shafter is a graduate of the University of Michigan.

SCHUYLER B. KNOX, vice-president of the Fort Pitt Bridge Works, whose office has been in Pittsburgh, Pa., sailed recently for Europe; on his return he will take charge of the business of the Fort Pitt Bridge Works in the East and will have his offices in New York City, at 15 Park Row.

NICHOLAS S. HILL, JR., consulting engineer, New York City, has been elected president of the Hackensack, N. J., Water Co., succeeding Robert W. DeForest, who has been president for over forty years and who now becomes chairman of the board of directors. Mr. Hill has been consulting engineer to the company and one of its directors. Among many other things, Mr. Hill has served as engineer-secretary of the sewage commission, chief engineer of the electrical commission, and chief engineer of the water department—all at Baltimore, Md.; chief engineer of the New York Water Department, 1902-4; and on laying out the water systems of Albany, N. Y., and Tampa, Fla. In 1915 he was president of the American Water Works Association.

ISADOR W. MENDELSOHN, associate sanitary engineer, U. S. Public Health Service, has been transferred from Interstate Sanitary Districts 5 and 6 with headquarters at San Francisco, Calif., to take charge of Interstate Sanitary District 3 with headquarters at Chicago, Ill. Mr. Mendelsohn has been engaged in public health engineering work at Yellowstone National Park and in the western states, under H. B. Hommon, sanitary engineer, while on the western detail. Before that he was at Washington, D. C., in charge of Interstate Sanitary District 2 of the Public Health Service. At Chicago he succeeds J. I. CONNOLLY, associate sanitary engineer, who resigned to become chief of the Bureau of Sanitary Engineering of the Chicago City Health Department.

Obituary

G. A. SEARS, Seattle, Wash., president of the Union Bridge Co., of Portland, Ore., and one of the well-known bridge builders of the Northwest, died from a sudden heart attack at Spokane March 1, aged 57 years. Among the bridges built by Mr. Sears' firm were the Pasco-Kennewick bridge over the Columbia River and the Willamette River bridge at Albany, Ore.

P. SANFORD ROSS, of Newark, N. J., president of P. Sanford Ross, Inc., an engineering and contracting firm, died March 5 at his home in Newark. For many years the firm has been widely engaged in the construction of railroad terminals and shops and foundations in New Jersey and elsewhere, and in harbor and dock work in New Jersey, New York, Baltimore, Washington, Savannah and other places.

ALBERT CAVALLO JEWETT, a construction and field engineer, died at his home in Papeete, Tahiti, Society Islands, on Feb. 3. Mr. Jewett, who was about 56 years of age and a native of Kentucky, was connected with the San Francisco Office of the General Electric Co. in 1893. Since 1899 he was engaged in construction engineering in the Far East, directing electrical installations in India, Kashmir, Brazil, and Afghanistan.

EUGENE J. RIGHTS, professor of civil engineering in the College of Agriculture and Mechanical Arts at Mayaguez, Porto Rico, died Feb. 15. He was born in Oklahoma in 1872 and graduated from Lehigh University in 1895. He was employed on the Massena canal and later on the location and construction of the New York & Ottawa R.R. He spent several years inspecting steel at various eastern mills and in 1907 became erection engineer for the Shoemaker Bridge Co. In 1923 he took the position in Porto Rico, going there to live on account of poor health.

JOSEPH F. HASSKARL, civil and consulting engineer, Philadelphia, Pa., died March 5 at his home in Philadelphia, aged 62 years. Mr. Hasskarl joined the United States Engineer Department in 1883 and was engaged in surveys on Illinois rivers and on the Mississippi; later he assisted in surveys of the Rio Grande and of Delaware River and Bay. After considerable improvement work on the Delaware, he was in 1897 made principal assistant engineer in charge of works on the Delaware River and Bay from Trenton to the sea. In 1907 he became assistant director of the department of wharves and docks at Philadelphia, in 1909 acting director and in 1911 director. In 1924 and 1925 he was a member of the Engineering Board of Review of the Chicago Sanitary District.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Many Railway Appliances at Chicago Show

Signal and Crossing Protection Devices More Plentiful than Heretofore— New Track Appliances Scarce

Engineering News-Record Staff Report

THE INCREASING importance of protection both along railway lines and at grade crossings was indicated by the increased amount of signaling devices of all kinds displayed at the 18th annual exhibition of the National Railway Appliances Association, held in the Coliseum at Chicago, March 8-11, in conjunction with the annual convention of the American Railway Engineering Association, and the Signal Section of the American Railway Association. Such devices are more suitable for striking exhibits than most railway appliances and as a result the show presented an even more pleasing appearance than usual.

Not many new purely track appliances were on display except some additions to the ever-increasing supply of rail anchors. There were two pieces of equipment, however, which attracted considerable attention. One, a tapered joint shim for insertion over the top of the angle-bars in rail joints which have become worn, displayed by the American Fork and Hoe Co., and the other, a rail joint expander made by W. F. Price & Sons of Topeka. The latter is designed, primarily, for increasing the space between rail ends for the insertion of insulated end posts but also can be used for adjusting the expansion space in track where the expansion has become "bunched." The expander can be applied to rail joints without interfering with traffic.

An improved type of engine house and freight house door was displayed by the Richards-Wilcox Mfg. Co. It is a laminated wooden door with a light rigid steel frame by means of which the weight of the door is transmitted to the standard door hangers of the company.

Smoke Jack Developments

Two improved types of smoke jacks for engine houses were on display. A combination protected metal and aluminum-alloy jack by the H. H. Robertson Co. and a sheet asbestos jack by the Johns-Manville, Inc. The former jack is a new departure, aluminum alloy being used for the frame and for all parts exposed to blasts from the locomotives the other parts being made of protected steel. The Johns-Manville jack is similar to the company's former jack except that the design has been modified to permit the use of dense sheets in place of molded sheets.

An exhibit by the Armco Culvert and Flume Manufacturers Association of a method of jacking culvert pipe through railroad embankments attracted considerable attention. The same company had a small scale model of a portable snow-fence made of corrogated sheets on exhibition.

Track cars were more in evidence than ever and the new models included some unusually large ones with automobile-type engines. A tie lifter for use in loading large quantities of ties by crane or derrick was displayed for the first time by the Hussey Mfg. Co.

Although it was not possible to show one of the new oil-electric locomotives which are arousing so much interest among railroad men, the Ingersoll-Rand Co. had data concerning them available for those who wished to get up-to-date information on the subject. This company, the Chicago, Pneumatic Tool Co. and the Cleveland Pneumatic Tool Co. each exhibited improvements in air operated tools.

Something different in the way of a crossing gate is being put on the market by the Automatic Grade Crossing Signal Co. of Chicago. The gate is mounted on a pivot so that it can revolve about the base in case it is run into.

Officers of the association for the ensuing year are: president, W. B. Murray, vice-president, Murray Train Control Corp.; vice-president, L. E. Weidman, The Frog Switch & Manufacturing Co., and secretary-treasurer, C. W. Kelly.

Appoint Committee on Billet Reinforcing Steel

To Study Production, Distribution and Use of Grades as a Basis for Standardization Program

IN ACCORDANCE with the will of the conference of manufacturers, consumers, distributors and technical bodies interested in reinforcing steel, which was held Jan. 26 in Washington, D. C., under the auspices of the National Committee on Metal Utilization, a committee has been appointed by the Department of Commerce, this committee to conduct an investigation to determine what grade or grades of new billet concrete reinforcement should be recommended for adoption.

The personnel of the committee which has been requested to report about Oct. 15 is as follows: C. L. Warwick, secretary, A. S. T. M.; E. F. Kenney, Bethlehem Steel Co.; J. J. Yates, Central Railroad of New Jersey; C. F. W. Rys, Carnegie Steel Co.; C. Louis Meyer, Concrete Engineering Co.; A. E. Lindau, American System of Reinforcing; O. W. Irwin, Truscon Steel Co.; Col. D. H. Sawyer, A. G. C. In addition to the above members, a representative from both the American Association of State Highway Officials and the American Institute of Architects is to serve on this committee.

In speaking for the jobbers before the meeting of Jan. 26, which was briefly reported in *Engineering News-Record*, Feb. 4, A. E. Lindau said in part: "We wish to make it clear that in advocating the adoption of one standard grade of reinforcing steel we are considering only new billet stock. We realize the difficulty of including other materials used for reinforcement, as, for example, rail steel or bars rolled from car axles." Mr. Lindau pointed out that the use of the three grades, structural, intermediate, and hard, made it necessary for the jobber to carry large inventories with a consequent tying up of capital. Figures were quoted showing that at least 100,000 tons of steel are carried in warehouse stock, of which 35 per cent is of structural grade, 55 per cent of intermediate grade, and 10 per cent of hard grade.

C. E. Skinner, chairman, American Engineering Standards Committee, offered the active effort of the committee and warned the conference that should a single specification be adopted whose requirements were very close, the extra care required for the production of the material within the close limits might make the cost greater in the end than if a more liberal specification or more than one specification was permitted. There are 57 specifications for reinforcing bars now listed in the National Directory of Commodity Specifications.

Richard L. Humphrey, of the A. S. T. M., presented a statement for Mr. Warwick, secretary of the society, in which he said that the selection of a particular grade "does not in our opinion make it necessary to modify existing specifications by eliminating therefrom requirements for the other two grades. It is our belief that any specification work should be handled by an appropriate specification-making body such as ourselves."

E. E. Hughes, president, Rail Steel Products Association, spoke in protest against the adoption of a single grade of new billet steel for reinforcement. "I can't see how it would be possible to bring out a single standard type of specification that would take in the lower limits represented by structural steel and the upper limits represented by high carbon steel. You have three specifications and grades of steel, and I feel that the rail steel must be taken into consideration in a problem of this kind."

Secretary Hoover appeared before the conference and told of the efforts of the Department of Commerce merely to bring various associations together to discuss and work out their common problems.

Simplification of Wire and Sheet Metal Gages

The situation in this country with respect to the designation of the size of wire and thickness of metal sheets and plates is more or less complicated by the use of a wide variety of gaging systems. Some of these gages for wire depend upon the material, while others depend on the use for which the wires are intended, and for sheets and plates

the gages vary according to the material and also as to relative thickness.

The Society of Automotive Engineers has requested the American Engineering Standards Committee to take up the unification of methods of designating the thickness of wire and of metal sheets and plates. As one of the first steps, the American Engineering Standards Committee has called a conference for March 18 of all groups interested to discuss the desirability and possibility of unifying the various existing gage systems into a consistent national system or systems. The Division of Simplified Practice will undertake to bring about production surveys relative to this matter in the near future.

Concrete Road Yardage

For February the square yardages included in concrete pavement contract awards, according to the Portland Cement Association were: 2,726,611 for roads; 2,010,941 for streets; and 274,836 for alleys; or a total for the month of 5,012,388 sq.yd.

The accompanying table sumarizes the statistics for the current year:

SQUARE YARDS OF CONCRETE PAVEMENT AWARDED DURING 1926

Month	Roads	Streets	Alleys	Total All Classes
Jan.....	2,161,415	1,410,201	57,218	3,628,834
Feb.....	2,726,611	2,010,941	274,836	5,012,388
Total	4,888,026	3,421,142	332,054	8,641,222

Business Notes

AMERICAN LOCOMOTIVE CO. and the Railway Steel Spring Co., through their boards of directors, have agreed upon a merger of the two companies. When this merger is completed it is planned that William H. Woodin will become chairman of the board of directors of the enlarged American Locomotive Co., and Mr. Frederick F. Fitzpatrick, now president of the Railway Steel Spring Co., will become president.

TOLEDO SCALE CO., Toledo, Ohio, announces that a controlling interest in the company has been acquired by Hubert D. Bennett. Mr. Bennett has been elected president of the company and has assumed active direction. O. C. Reeves, general factory superintendent of the company since 1905, has been elected first vice-president and W. C. Gookin, the general sales manager, has been elected second vice-president. The company manufactures a large line of automatic weighing and counting scales for industrial use, ranging in capacity from 8 oz. to 30 tons, and other scales for special purposes.

STUEBING-COWAN CO., Cincinnati, Ohio, announces its formation as the result of a merger of the Stuebing Truck Co., Cincinnati, Ohio, and the Cowan Truck Co., of Holyoke, Mass., both manufcturers of lift trucks and platforms. The total unit installations of both companies reaches 264,000 in American and throughout the world. The merger represents a combination of assets of approximately $1,000,000.

HELTZEL STEEL FORM & IRON CO., Warren, Ohio, has appointed Chadwick Bros. Co., Milwaukee, Wis., as its representative in the state of Wisconsin.

Equipment and Materials

One-Man Leaning Wheel Grader Attaches to Tractor

A one-man grading oufit consisting of a leaning wheel grader attached to the rear of a McCormick-Deering 10-20 tractor is a new product of J. D. Adams & Co., Indianapolis, Ind. The operator handles the equipment from the grader platform through mechanism attaching to the steering wheel and operating levers and pedals of the tractor. A "T" handle control at the operator's left hand extends to the gear shift lever of the tractor. The tractor clutch is controlled by a steel cable, which in turn is controlled by a clutch pedal on the grader platform at the operator's right foot. The steering wheel of the tractor is removed and a special steering device is put on consisting of several close-fitting universal joints. These controls are so arranged that they operate effectively even though the tractor is at right angles with the grader as happens when turning around. The grader is furnished with either a 7 or 10-ft. blade and attachable extensions are available, increasing these lengths to 10 and 13 ft. respectively. The grader is furnished with either steel or rubber tires and with plain or Hyatt roller bearings. The distance between the grader axle and the rear axle of the tractor is 12 ft. 3 in. The weight of the grader is approximately 1,600 lb.

Demountable Truck Body Basis for Separate Container System

For handling brick, concrete blocks, and similar material through their various stages of transportation, the American Truck and Body Co., Martinsville, Virginia, has developed a demountable truck body which may also be used as a shipping container. The brick or blocks are piled on a pallet at the point of manufacture, the pallet later forming the end gate or closure for the open end of the body.

The details of the truck body are shown in the illustration. The unloading hoist arrangement slides the body to the back of the truck and "ends it up" on the ground.

In transportation use the body would remain over the material from the time it left the point of manufacture until it reached its final destination. This would save cost of rehandling each separate brick or block at intermediate transfer points as is now often necessary where a combination of railroad, boat and truck transportation is used.

Wedge-Shaped Tooth Sockets Integral With Dipper Front

The new ¾-yd. dipper of the Erie Steam Shovel Co., Erie, Pa., features four tapered sockets for the teeth cast as integral parts of the manganese front plate, which is 1 in. thick and extends 9 in. up on both sides. The

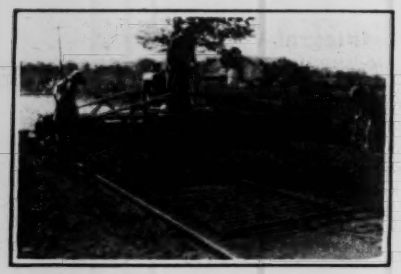
placing of the outside teeth at the extreme corners is claimed to be a considerable advantage when side cutting on heavy banks. The teeth are reversible and made of chrome manganese steel. No bolts or rivets are necessary to hold the teeth which are fastened by firmly wedging them against soft steel shims. The teeth are easily removed by driving a small drift wedge under them through a hole provided in the back of the socket for this purpose.

Finishing Machine Combines Screed, Tamper and Belt

The sequence of operations on the new concrete road finisher of the Lakewood Engineering Co., Cleveland, Ohio, provides first for screeding and tamping, then a second screeding and tamping, and lastly the use of the screed and belt, eliminating for the final operation the use of the tamper. In other words, the final operation is used to obtain an easy riding surface free from waves.

At the front of the machine is the screed, or strike-off, which is of steel, adjustable for crown and 12 in. wide on the bottom. It is driven from 35 to 40 strokes per minute. The tamping member, which is hung on springs behind the screed, has a quick, snappy up and down movement. At the rear of the machine is the belt float with the driving mechanism very much improved from that used on previous models of finishers.

The mechanical construction used is designed to provide for long life and freedom from breakdowns on the job.



An automotive type of sliding gear transmission with two speeds forward and two speeds reverse is employed. Cut gears are carried on alloy steel shafts which in turn are mounted on Timken roller bearings. The transmission is inclosed in an oil-tight housing and gears run constantly in oil. Large traction wheels, 14 in. in diameter, are used which are mounted on square shafts, eliminating the necessity of keys. By simplification of the side truck construction, no chains or traction gearing is required, the drive to each wheel being direct from inclosed worms and gears mounted on the transmission frame..

A stronger truss of channel frame construction is used, the central panel of which carries the complete transmission assembly. This central panel is identical for all widths of machines so that to change the width it is simply necessary to bolt on the new extension side members of the proper width and put in place the other cross members such as screed and tamper. The machine is driven by a Le Roi two-cylinder radiator cooled engine.

Publications from the Construction Industry

Concrete Mixers—CHAIN BELT CO., Milwaukee, Wis., describes its 5-S and 7-S mixers in a new booklet entitled "More Yards Per Day."

Valves—DARLING VALVE & MFG. CO., Williamsport, Pa., has recently published a new issue of its catalog No. 14 describing its complete line of gate valves. Illustrations and tabular data on all the different types of valves furnish the plan upon which the book is made up.

Tractors—GEORGE HAISS MFG. CO., INC., New York City, in its new bulletin No. 1225, describes its crawler "Traxion chassis" for Fordson tractor attachment. Specifications and illustrations are included.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

This Week's Contracts—Week Ago—Same Week Last Year

THE money value of contracts reported in the present issue of *Engineering News-Record* is here compared with the figures for corresponding weeks. Minimum costs observed are: $15,000 for water-works and excavations; $25,000 for other public works; $40,000 for industrial and $150,000 for commercial buildings.

Money Value of Contracts Let—Entire U. S.

Week Ending	Public Work	Private Work	Total Contracts
March 18, 1926	$20,805,000	$22,434,000	$43,239,000
March 11, 1926.....	13,029,000	73,613,000	86,642,000
March 19, 1925.....	16,809,000	21,533,000	38,342,000
Heaviest Week			
1926, Mar. 11.....	13,029,000	73,613,000	86,642,000
1925, Sept. 3.....	16,215,000	69,424,000	85,639,000
January 1 to date			
1926.....	182,141,000	372,896,000	555,037,000
1925.....	162,648,000	283,591,000	446,239,000

Materials Demand Trifle Under Year Ago

Improvement in Steel Noted Since Mar. 1—Brick Buying Active—Cement Mill Stocks Heavy

THE steel market is stronger now than it was eighteen days ago, despite the slightly unfavorable statistical position of unfilled tonnage.

Orders on books of the U. S. Steel Corporation, Feb. 28, 1926, amounted to 4,616,822 tons, against 4,882,739 on the last day of the month preceding and 5,284,771 tons on Feb. 28, 1925. This apparent recession in demand was due to the shipping out of materials from the mills at a rate faster than that at which orders were received.

On March 10, the date on which the unfilled tonnage was announced, steel common showed a net advance of 1⅛ points for the day on the New York Stock Exchange.

With mill operations at about 94 per cent of capacity, an increased demand for steel structurals and automobile sheets has been evident since the first of the current month.

Ingot production, all companies, as calculated by the American Iron and Steel Institute, amounted to 3,795,139 tons for February, compared with 4,153,545 during the month preceding. A total of 3,756,243 tons were produced in February of last year. The seasonal drop from January to February was 11 per cent in 1925 as against 9 per cent this year, which gives the production figures a more favorable appearance.

The lumber movement, as a whole, is well ahead of the corresponding period (Jan. 1 to date) last year. Latest available weekly statistics from the National Lumber Manufacturers' Association show a slight drop in unfilled orders, most of it in the Southern pine mills. The following table shows the national soft wood lumber movement for the three weeks indicated:

	Week of Mar. 6 Ft. b.m.	Corresponding Week In 1925 Ft. b.m.	Preceding Week in 1926 Ft. b.m.
Production.	237,711,333	227,168,224	226,495,064
Shipments..	253,701,560	246,809,597	247,639,564
New orders.	255,649,152	223,828,120	256,892,933

The tabulation following compares the softwood lumber movement for the first nine weeks of 1926 with the corresponding period last year:

	Production Ft. b.m.	Shipments Ft. b.m.	Orders Ft. b.m.
1926....	1,985,731,431	2,179,113,293	2,243,087,233
1925....	1,937,756,655	2,024,004,737	1,949,510,976

There are more burned bricks at yards throughout the country and a more substantial volume of unfilled orders on books than were reported at this time last month by the Common Brick Manufacturers' Association of America. Shipments from yards are still seasonally slow in the presence of an unusually active demand. The situation as of Feb. 1, 1926 follows:

	Burned Brick on Hand M.	Brick Moved From Yards During Month M.	Orders On Books M.
Feb. 1, 1926.....	324,203	108,688	259,158
Jan. 1, 1926.....	316,023	137,788	253,490
Feb. 1, 1925.....	279,862	94,185	201,479

In contrast with the seasonal slackening of production, the upswing in cement shipments for spring construc-

tion has already started. The yearly peak of mill shipments is usually reached in mid-summer. Unprecedented reserve stocks are being held at mills throughout the country. In addition to a heavy anticipated demand another reason for the extensive mill stocks is that, owing to quick transportation facilities, dealers prefer to let the manufacturers carry the bulk of the reserve material. Following is the cement mill situation according to the Bureau of Mines:

	Production Barrels	Mill Shipments Barrels	Mill Stocks Barrels
February, 1926...	7,731,000	5,820,000	22,493,000
January, 1926....	7,887,000	5,672,000	20,582,000
February, 1925...	8,255,000	6,015,000	19,689,000

According to latest reports of the Department of Commerce, production of raw materials is about 8 per cent under a year ago while the output of manufactured products is 9 per cent greater.

Compared with this time last year, reserve stocks of raw materials are greater by 19 per cent and manufactured products, 2 per cent.

Unfilled orders for building materials are only 0.8 per cent smaller in volume than during the corresponding period in 1925.

Fabricated steel plate bookings for February show gain over the month preceding in refinery materials and equipment, tank cars, gas holders, stacks, etc.; a decrease is noted in oil storage tanks and blast furnace material.

Unfilled orders for steel furniture and shelving, vitreous china plumbing fixtures, and enameled sanitary ware increased, while bookings of railway specialty castings, motor truck production, and shipments of floor and wall tile, all classes, declined during the first month of the year.

Hawaii Continues Construction Activity

Another active year of construction is indicated for Hawaii, states a cable to the Department of Commerce from the Honolulu Chamber of Commerce. Buildings in process of construction in Honolulu, the principal city of the Islands, aggregate in value $4,000,000 and include banks, hospitals, hotels, business structures, and recreation buildings. Highway and harbor construction is also going ahead steadily.

The Governor of Hawaii has announced that a public improvement bond issue of $1,345,000 will be floated in April and that of the total amount $500,000 will be used in constructing the Hilo wharf and $200,000 in purchasing a 40-acre extension for the University campus.

Erection of a war memorial is planned for Honolulu, at an estimated cost of $250,000, including the expense of dredging Waikiki swimming pool. A Federal road planned for Hawaii National Park will extend to the top of Haleakala, making it possible for automobile tourists to attain an altitude of 10,000 feet above sea level and to view at close range one of the largest extinct craters of the world.

Railways Announce Modification In Florida Freight Embargo

Due to the progressive improvement that has taken place in the past few months in the railroad transportation situation in Florida and the practical elimination of congestion of carload traffic, north of Jacksonville and other gateways, destined to points in Florida, a substantial modification of the statewide embargo that has been in effect for several months on practically all freight shipments into that State, is announced by the Car Service Division of the American Railway Association.

Effective Feb. 22, 1926, all commodities were placed on the free list except those enumerated below and for their movement permits must be obtained by receivers of freight, under the plan inaugurated some time ago by the Florida Division of the Southeast Shippers' Regional Advisory Board. Those commodities against which the embargo will continue to apply for an indefinite period are: Automobiles and trucks; brick, all kinds; cement, including all kinds, cement blocks and shapes; iron plates and sheets, including corrugated and galvanized iron and metal laths; lumber and logs, all kinds except crate material and car strips (Crate material is defined as knocked down crates in shooks or panels cut to size and short logs destined to crate mills); lime and plaster; plaster board, including all prepared or manufactured building board under various trade names, and building paper; poles and piling; pipe, all kinds, including cement, iron and tile pipe; roofing materials including roofing paper, shingles, and roofing tile; structural steel and steel shapes; sand, stone, gravel, slag, clay and screenings, including curbing, stone blocks and marble tile, all kinds, also roofing, building and floor tile and flue linings; household goods as specified in consolidated classification.

For the movement of household goods, permits will be issued without delay upon presentation of statement that consignee has a house or apartment or other place into which to put the consignment promptly on arrival.

Industrial Building Active in Australia

The State of New South Wales, particularly the city of Sydney, is looking forward to a year of unusual industrial activity, according to reports received in the Department of Commerce from Trade Commissioner E. G. Babbitt, Sydney.

Conservative estimates place the value of proposed industrial buildings in that city during the present year at £10,000,000, and it is expected that other projects will develop as the year advances. A large automobile body-building and assembling plant, at least two hosiery mills, a soap factory and a number of smaller factories are among those proposed.

Increased prosperity in secondary industries has made this expansion possible, and Sydney industrialists believe that 1926 will be the biggest in the history of Australian manufacture.

Continued Decline in Shipbuilding Throughout World

World shipbuilding at the close of 1925 had declined to a new low post war level and only 2,046,000 gross tons of steel steamers and motorships were under construction at that time, according to the Transportation Division of the Department of Commerce. This total represents a decrease of 131,000 tons, or 6 per cent under that on the ways at the end of the third quarter and a decrease of 404,000 tons, or 16½ per cent from that under construction at the close of 1924. Moreover, launchings during the fourth quarter of 1925 exceeded new work by 140,000 tons and a suspension of work was ordered on 113,000 tons, 97,000 of which were in Great Britain and Ireland.

Motorships continue to be the outstanding features in shipbuilding. The total under construction on December 31, 1925 was 84,000 tons more than on the corresponding date of the preceding year, whereas the total of steamers was 488,000 tons less. Of the aggregate shipping under construction at the close of 1925 motor vessels composed nearly 50 per cent, while they composed only 37½ per cent a year earlier.

The decline in ship building has been most severe in Great Britain and Ireland and in Germany, amounting to 415,000 tons, or 32 per cent and 119,000 tons, or 33⅓ per cent, respectively, during the year ended Dec. 31, 1925. Italy, in marked contrast, has made great progress and the vessels in the ways in that country during the same period, increased 156,000 tons, or more than 100 per cent. The United States also has made a notable advance, 44,000 tons, or 88 per cent.

Proposed Work 13 Per Cent Ahead of Year Ago to Date

Engineering construction projects throughout the United States, Jan. 1 to date, definitely reported as proposed, are at least 13 per cent ahead of the corresponding period in 1925, according to *Engineering News-Record* statistics.

Contracts awarded all classes, are 24 per cent greater thus far in 1926 than during the period Jan. 1 to date, last year.

Comparing the figures, by states, from week to week, gains in proposed work are noted as follows: **waterworks**, Mississippi, Missouri, Oklahoma and California gained, Wisconsin shows no loss and there is improvement in this class of work throughout Canada; **sewers**, Ohio and California; **bridges** (public) Illinois and Oklahoma; **streets and roads**, North Carolina, Illinois, Wisconsin, Missouri and Oklahoma—Georgia shows no recession; **industrial buildings**, New York, Pennsylvania, Ohio, Wisconsin, Michigan, Oklahoma and Texas; **commercial buildings**, Maryland, Florida, Louisiana, Ohio, Indiana, Illinois, Wisconsin and Michigan, Canada shows gain in this classification; **public buildings**, Massachusetts, Florida, Michigan, Iowa and Oklahoma. Minnesota projects hold at about the same volume.

Weekly Construction Market

THE trend of the wholesale market is downward; building materials being less affected, perhaps, than general commodities.

Two notable exceptions to this tendency are found in the present course of prices on Douglas fir along the West coast and on linseed oil in the Minneapolis district.

Raw linseed oil (5 bbl. lots) advanced from 94½c. to 96¾c. per gal. f.o.b. Minneapolis, during the week. This is equivalent to a rise of 0.3c. on the pound basis.

In contrast with the prevailing firmness in Northwest fir, come reports of a slight but probably temporary easing in Southern pine prices since the first of the month.

Advices received from various parts of New York State show marked firmness existing in quotations on cement, cast-iron and steel pipe, while window glass and linseed oil continue to show declining proclivities.

In the iron and steel market the downward turn in coke prices, which might normally be expected to result in easier pig-iron quotations, is offset by a rising tendency in iron ore. Little actual change, however, occurred during the past week. Steel prices also remain steady with some prospects of increased demand in structurals, pipe, sheets, tin plate, automotive and railway equipment and supplies. Mill quotations are: bars, $2; shapes, $1.90@$2; plates, $1.80@$1.90 per 100 lb., Pittsburgh.

Since the recent wage agreement, whereby the New York building trades mechanics were granted a base rate of $12 per day for the key trades, retroactive to March 1, there has been no definite settlement regarding the status of apprentices in relation to that of helpers except in the case of the electrical workers.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products									
Structural shapes, 100 lb.	$3.34	$3.40	$4.15	$3.10	$3.35	$3.07½	$3.30	3.35	$3.75
Structural rivets, 100 lb.	4.50	3.50	4.75	3.50	3.75	4.65	5.00	3.75	5.50
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.30	3.38	3.00	3.25	3.77½	3.10	3.25	2.30
Steel pipe, black, 2½ to 6 in. lap, discount	48%	53%	53.6%	51%	54.25%	36%	39.2@51%	45%	59.49
Cast-iron pipe, 6 in. and over, ton	50.60@52.60	45.25	54.00	49.20@50.20	53.00	64.00	52.00	55.00	55.00
Concreting Material									
Cement without bags, bbl.	2.50@2.70	2.35	2.05	2.10	2.32	2.84	2.31	2.65	1.80
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	2.00@2.20	1.65	1.90	1.80	1.50	1.25
Sand, cu.yd.	1.00	60	2.00	2.25	1.25	1.00	1.40	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.50	2.83	2.00@2.20	1.75	2.50	1.70	3.00	1.50
Miscellaneous									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	63.00	34.00	56.00	57.50	37.75	34.75	27.00	25.00	65.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl.	2.25@2.75	1.50	1.85	2.25	1.35	2.70	1.60	2.80	10.00
Common brick, delivered, 1,000	21.40	10.50	11.10	12.00	13.50	12.00	15.00	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.0977	.10	.075	.....	.075	.....	.10	.12
Hollow partition tile 4x12x12, per block	.1112	.0977	.10	.075	.07	.075	.108	.10	.10
Linseed oil, raw, 5 bbl. lots, gal.	.83¼	.90¾	1.13	.85	+.96¾	1.06	1.02	1.12	1.12
Common Labor									
Common labor, union, hour	.62½@.75	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.82½	.45@.55	.35@.50	.50	.50	+.25@.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net and hydrated lime, f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Labor—Concrete laborers' rate, 93¾c.; building laborers, 75c.; excavating laborers, 62½c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job; pine is 4-in. instead of 3-in.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.60 for Sheboygan. Common labor not organized.

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of March 4, the next on April 1.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Stone and tile are delivered; sand, gravel, lime and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.65). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3½-in., $59.49.

Business Briefs

Call money quoted at 4½ per cent, Mar. 16; year ago, 3½ per cent.

Time loans: sixty-ninety days, 4⅝@4¾; four-six months, 4⅝@4¾ per cent.

Commercial paper: best names, 4¼ per cent; other names, 4¾ per cent.

On March 1, 1926

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For Explanation and Details of Indexes Since 1913 See the First Issue of Every Month